

Project Title: Design Construction, Operation and, maintenance of STP & Sewer Network at Saidpur Patna Bihar under NGRBA

EIA Report, Saidpur Sewerage System

11th August 2015

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0.0 EXECUTIVE SUMMARY

The Government of India has given Ganga the status of a National River and has constituted the National Ganga River Basin Authority (NGRBA) on 20th February 2009, for the comprehensive management of the river. The main objective of the NGRBA is to ensure effective abatement of pollution and conservation of the river Ganga by adopting a river basin approach for comprehensive planning and management. In regards to this initiative, under pollution abatement programme NGRBA proposes sewerage works for Saidpur Zone, Patna. This zone covers the north-central part of Patna city and is a high density zone. The existing sewerage infrastructure was planned and constructed in the year 1937 which was augmented at different stages of Ganga Action Plan. The present treatment facilities are not fully operational because the present condition of the STP has not only been outlived its life but many of the places/localities are answered. At most of the places, all households are discharging their sewage through open drains which ultimately find its way into the river Ganga. Moreover, there is also an urgent need to augment the capacity of existing sewage treatment plant to cater to the rate of population growth. As per the Environmental and Social Management Framework (NGRBA, 2011), the implementation of such river pollution mitigation projects under the NGRBP is anticipated to encounter a variety of environmental and social issues/problems. Therefore the study of environment and social sector is required for analyzing the impacts of proposed project and suggesting the management plans to handle any negative impacts.

0.1 Portfolio of Investments under NGRBA

The portfolio of investments under the NGRBA program includes the following:

- Sewerage and sanitation systems/sewage treatment plants (new/up gradation)
- Solid Waste Management
- Industrial Pollution Control Initiatives
- River front Management initiatives

These investments in the first phase of program is spread across several cities and/or towns within Ganga main stem states of Uttarakhand, Uttar Pradesh, Bihar, Jharkhand and West Bengal and may be extended to entire Ganga river basin comprising of 11 states in the later phases.

0.2 Sewerage Project for Saidpur Zone of Patna

Patna city covering an area of 100 sq.km is subdivided into 5 district zones (Digha, Beur, Saidpur, Pahari, Karmali chak). The Bihar Urban Infrastructure Development Corporation (BUIDCo) based on topography and contributory population has divided the Patna city into six zones for complete sewerage system of the city. As per the new zoning plan the Saidpur Zone of Patna now covers two zones namely Zone –III & IV A (N). This zone forms the north-central part of city and covers 13.77% of total project area. The west side of this zone is bound by Mahatma Gandhi Maidan, Rajendra path, Bakerganj etc. The south side area of this zone includes Rajendra Nagar, Ghrounda, Delhi-Howrah railway line, etc. and on east side it has the area named Bhikhana Pahari, Lal bagh Sharif Colony, etc. The north part is bounded by Ganga River.

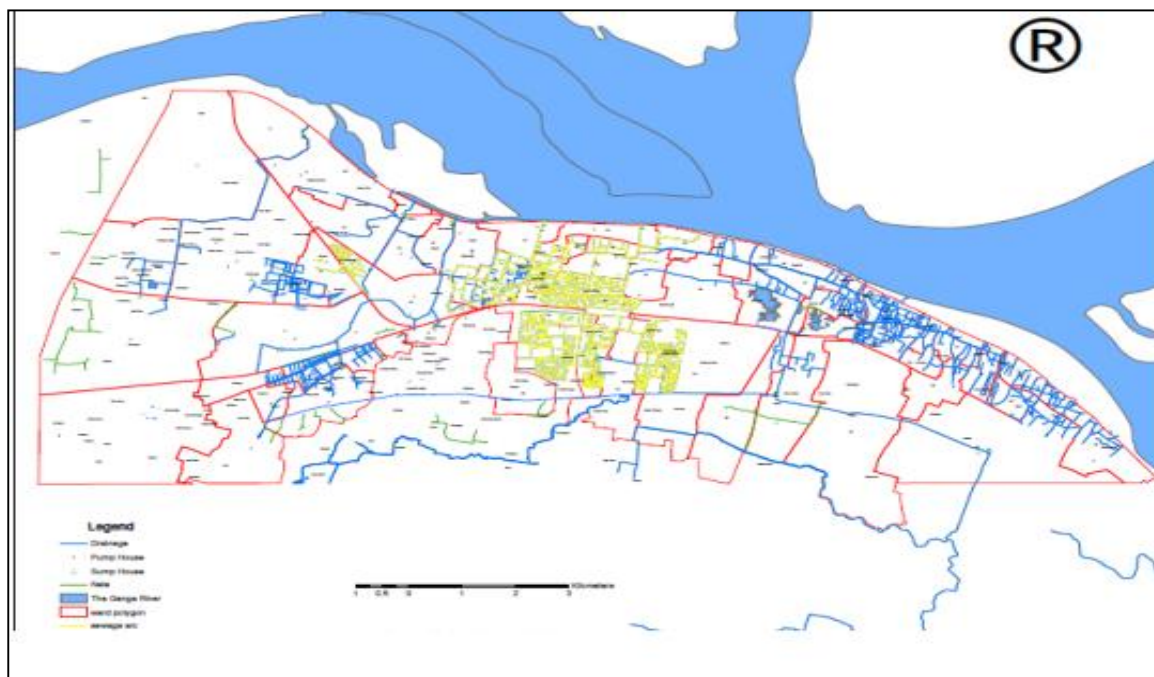


Figure-0.1: Existing sewerage and drainage network in the city

At present Saidpur zone has an existing ASP based STP capacity of 45 MLD which is catering a load of 33 MLD with primary level of treatment. The treated sewage is then pumped to the Rampur drains to Barmutta nala and finally leads to the Punpun river. The river Punpun on southern side flows parallel to the city and join river Ganga at 20 km away. As part of the study, a comprehensive water analysis of the water quality of river Ganga and river Punpun as well as inlet and outlet of the Saidpur STP has been performed through the Bihar State Pollution Control Board. The study found that the water quality of the river Ganga as well as river Punpun is severely polluted in terms of total coliform and fecal coliform and does not fit the water quality standard for bathing. Even the treated water quality from the Shaidpur STP does not meet the general discharge standards for inland surface water.

Table 0.1: Effluent Quality Report of STP At Saidpur

Parameter		General standard for discharge on inland surface water as per CPCB
BOD(mg/l)	46	30
COD (mg/l)	96	250
TSS (mg/l)	104	100

The ultimate population for Zone-III & IV A(N) is projected as 4.02 lacs, 5.40 lacs & 6.93 lacs for years 2017, 2032 & 2047 respectively. On the basis of population projections for immediate (year 2017), intermediate (year 2032) and ultimate (year 2047), sewage generation from this zone is calculated at 48.23 MLD, 64.78 MLD and 83.11 MLD respectively. Considering the density of population, absence of proper sewerage network, proximity to the Ganga river and the point of confluence, it becomes more important to provide sewerage and treatment infrastructure for the area. The major components of the proposed project include:

- 228 km long sewerage network including all required trunk/ branch/ lateral sewer.
- Augmenting Shaidpur STP of capacity to 60 MLD by 2032 and 83 MLD by 2047

- Operation and maintenance

As per DPR, the total cost for the sewerage lines and sewage treatment plant will be Rs. 268.63 crore and Rs. 195.23 crore respectively.

0.3 Associated Implementing Agencies

(a) NGRBA

The Central Government, by a notification dated 20.2.2009, as set up 'National Ganga River Basin Authority' (NGRBA) as an empowered planning, financing, monitoring and coordinating authority for the Ganga river, in exercise of the powers conferred under the Environment (Protection) Act, 1986. The Prime Minister is ex-officio Chairperson of the Authority, and it has as its members, the Union Ministers Concerned and the Chief Ministers of states through which Ganga flows, viz., Uttarakhand, Uttar Pradesh, Bihar, Jharkhand and West Bengal, among others. The objective of the Authority is to ensure effective abatement of pollution and conservation of the river Ganga by adopting a holistic approach with the river basin as the unit of planning. The functions of the Authority include all measures necessary for planning and execution of programmes for abatement of pollution in the Ganga in keeping with sustainable development needs.

(b) State Level Authority

The Government of Bihar (GOB) through its Urban Development and Housing Department (UD&HD) has been implementing both these program in the state. In Bihar State, Patna & Bodh- Gaya cities had been identified as mission cities under JNNURM. Apart from these two mission cities, other Urban Local Bodies (ULBs) in Bihar had been selected for providing Infrastructure facilities under UIDSSMT Programme.

(c) Bihar Urban Infrastructure Development Corporation Ltd

BUIDCo is a Flagship company to implement and accelerate urban infrastructure projects in the State of Bihar. These projects include basic infrastructure amenities such as Solid Waste Management, Water Supply, Drainage Network and Sewerage & Sewage Treatment. Also, projects of urban beautification like River Front Development, Amusement Parks, Commercial works, Hotels etc. are also being developed by the BUIDCo. The preparation of a Comprehensive Master Plan of Sewerage Scheme and Preparation of Detailed Project Report (DPR) is now taken over by the BUIDCo from PMC.

(d) Bihar Urban Development Agency

BUDA, working under Urban Development and Housing Department (UD&HD), is engaged in systematic planning, infrastructure development, and creation of civic amenities in urban and semi-urban areas in the State of Bihar. BUDA has also been designated as the State Level Nodal Agency (SLNA) for implementation of JNNURM & UIDSSMT program to work as a facilitator in effective implementation of the projects in the identified ULBs. These program are to be implemented through ULBs.

0.4 Scope of EIA

The proposed sewerage project will be implemented under NGRBA and for that assistance has been sought from World Bank. According to screening study and as per NGRBA's framework the project falls under low impact category and hence Environmental clearance and EIA study is required. But keeping in view of volume of work and also as per World Bank's safeguard policy (OP: 4.01: Environment Assessment) an Environmental Assessment warned as the proposed development work envisages to have some impact (adverse or positive) to surrounding environment.

(i) Environmental screening Check List

Question	Details
Biosphere Reserve	There is no Biosphere within 1 km of the project
National Park	There is no Biosphere within 1 km of the project
Wildlife/Bird Sanctuary	There is no Wild Life Sanctuary within 1 km of the project
Game Reserve	No Game reserve within project vicinity
Tiger Reserve/Elephant Reserve	No Tiger / Elephant reserve within 1 km of the project
World Heritage Sites	No World Heritage Sites is visible within 1 km of project vicinity
Land Use	No change as there is no land acquisition
Water	The project objective is pollution abatement of river water through interception and treatment of nalas falling into the river
Air	No negative impact

(ii) Outcome of Environmental Screening

1.	No EIA Required	The project falls under low impact category and will have overall positive benefits on the life and environment of the people
2.	Regulatory Clearance Required	No

0.5 Policy, Legal and Administrative Framework

The following laws and regulations are application to the environmental aspects of the proposed project:

- Policy and regulatory framework of Govt. of India;
- Environmental Policy of the respective State Governments;
- Legislations applicable to the construction activities;
- Environment and Social Management Framework of NGRBA

The Project is seeking financing from World Bank and hence their environmental and social safeguards are also applicable to this Project.

0.6 Requirement of Environmental Clearance as per EIA notification 14th September 2006:

The proposed project is renovation cum augmentation of sewage treatment plant. Since construction of sewage treatment plant and does not attract EIA clearance the project will not require Environmental clearance from MoEF/SEIAA.

Other Applicable Legislation:

- The Air (Prevention and Control of Pollution) Act, 1981 and Water Prevention and Control of (Pollution) act, 1974 will be applicable;
- The Noise Pollution (Regulation and Control) Rules, 2000 will be applicable;

- The Ancient Monuments and Archaeological Sites and Remains Act, 1958 is not applicable as such
- Contract Labour (Regulation & Abolition) Act, 1970 shall be applicable
- Minimum Wages Act, 1948 shall be applicable
- Child Labour (Prohibition and Regulation) Act, 2000 shall be applicable
- Forest (Conservation) Act, 1980 is not applicable
- The project also does not fall within 10 km radius of a wildlife sanctuary area. Though Gangetic Dolphin (A schedule-I) animal reported in this section of Ganga in Patna, however there presence is mostly concentrated in left bank now. However only the presence does not attract requirement of clearance under Wildlife Protection Act 1972.

The methodology adopted for the environmental and social assessment included secondary data analysis, carrying out scoping in the field, survey of the host population and discussion with key stakeholders including government officials and local residents. Based on these outcomes, a screening activity was conducted with the help of the screening checklist format provided in Environmental and Social Management Framework of NGRBA. Thereafter, environmental and social impacts were identified and assessed and a mitigation plan was developed based on the aforementioned.

0.7 Baseline Environmental Condition

As a part of the study, baseline condition was established through physic-chemical and biological sampling in and around the study area. Social study was undertaken to understand the cultural and social status of the residing community. The baseline information forms the basis to analyse the probable impacts of the proposed project vis-à-vis the present background environmental quality of the core study area. In environmental scenario it reflects the status of environmental entities like status of climate, geological features, air quality, water quality, waste management and existing green cover in the study area.

In general 5 km from the project boundary has been considered as Project Influence Area. Within this project influence area the mostly consists of built up area which also includes some old and important buildings. Very few open space is there within the Project Influence Area, the only prominent one is Gandhi maidan. There is no such natural sensitive area observed within the project influence area. However man made sensitive locations like Patna Medical College, Patna College, B.N. College, Patna Law College, temples along the Ghats, some old buildings and few schools are observed.

Meteorology: The climate in Patna is characterized by quite hot summers to moderately cold winters. In the Ganga basin the mean maximum and mean minimum temperature as recorded in Patna is respectively 31.9°C and 20.8°C. The relative humidity ranges between 80-93%. The mean annual rainfall is 1003.4mm. The maximum Wind speed is 177 km/h while the average wind speed during the year is 5 km/h. The wind direction near the river area varies from NE during the summer season to SW during the winter season.

Topography: Patna is located on the south bank of the Ganga River. A characteristic of the geography of Patna is its confluence of rivers. The Ganga River is joined by four other rivers: Ghaghara, Gandak, Punpun and Sone. Patna is unique in having four large rivers in its vicinity.

Geology: The area is a part of the Indo-Gangetic alluvium, one of the three main physiographic divisions of India, which separates Extra-Peninsular regions on the north from the peninsular region on the south. The quaternary sediments are deposited unconformable on the Achaean basement.

Physiography and Soil: The project area falls under active alluvial plain and the soil of the Patna river basin area is characterized by Calcareous alluvial (Ustochrepts Haplaquepts) i.e. it is slightly alkaline. This shows that the alluvium deposit in this region is old alluvium deposit.

Seismicity: The area falls under Seismic Zone-IV as per seismic map of geographical survey of India.

Air Quality: Central Pollution Control Board has two air quality monitoring stations in Patna under National Environmental Air Quality Monitoring Programme (NAAQMP). The air quality trend reveal that SO₂ concentration is at low, NO₂ concentration is at moderate whereas particulate pollution has reached to critical condition.

Water Quality: The river Ganga is at about 1 km from the project site. The river quality was found to be polluted in terms of E. coli and faecal coliform and do not satisfy the 'bathing water quality standard as per CPCB water quality criteria.

Flora and Fauna: Common trees include Shorea robusta (sal), Toona ciliata, Diospyros melanoxylon (kendu), Boswellia serrata (salai), Terminalia tomentosa (asan), Terminalia bellayocica (bahera), Terminalia arjuna (arjun), Pterocarpus marsupium (paisar), Madhuca indica (mahua).

The fauna reported in the area are mainly avifauna (highest diversity) followed by mammals and reptiles. The commonly reported avifauna in the study area are Common crow, Myna, Eagle, Sparrow, Babbler, Pigeon, Cattle Egrets, Red Vented bulbul, Drongo, Sparrow, Indian Roller etc.

Cultural and Heritage Resources: There is no important cultural and heritage resource notified by Archeological Survey of India around the project influence area.

The environmental impact assessment of the project was based on screening checklist method that identifies the impact level of various activities during the construction and operation phases. Various environmental factors such as the presence of eco-sensitive region in and around the project area, clearance of tree cover, improper storage of excavation spoils, flooding of adjacent areas, elevated noise and dust levels, damage to existing utilities were taken as checklist criteria for impact assessment of the project. Social criteria included factors such as requirement for land acquisition, displacement of tribes, loss of livelihood and gender issues.

Though the present project do not involve any major issues of land acquisition and has a overall positive impact by tapping the wastewater which was earlier polluting the river Ganga, based on the criteria-wise screening activity and the categorization of potential sub-projects of the NGRBP, the present project of sewerage work in Saidpur zone of Patna which involves 228 km of sewer lines, 5 pumping stations and an STP falls under high impact category.

0.8 Public Consultation

Local people are being adequately consulted as part of the project preparation. Focused group discussions as well as informal discussion with local people as well as project implementation authorities were conducted at different points of time as part of the Environmental Impact Assessment of the project. Most of the people have welcome the project and their views and suggestion are incorporated in the project and EMP.

While in baseline status of social section, it brings out the status of demographic composition of the population, general land-use feature of the wards and also details of the social survey outcomes at various consultations held in different wards of the sewerage district.

Although there would not be any permanent negative or adverse environmental or social impacts, but will have temporary impacts on water quality, air quality (impact on health), traffic blockages, safety hazards for pedestrians, possible damage to private property, possible interruption in commercial activity, and accidental breakage of other public infrastructure such as water pipes.

Social assessment clearly defines that no issue of land acquisition and livelihood loss is foreseen in the project. Hence, no compensation provision is required. However, if any loss of livelihood would be noticed during implementation of this project, then the affected party will be compensated according to Environment and Social Management Framework (ESMF) guidelines set by the NGRBA. Moreover, some inconvenience caused to the local public has been reported along with the local mitigation plan which they are adopting to overcome any nuisance in the ongoing JNNURM project. One strong suggestion which was identified from consultations was execution of construction work within a

scheduled time frame with provision of prior notice to residents, shop-owners. A public grievance mechanism (as prescribed by ESMF of NGRBA) is to be followed. There is a clear mention and highlighting if the social development issues and outcomes in this report. A section chalking out institutional mechanism, capacity building requirements and monitoring and evaluation mechanism is also present.

Table 0.2: Impact and its mitigation measures:

Phase	Component	Key temporary Impacts	Key Mitigation Measures
Environmental			
Construction Phase	Environmental sensitive areas	There are no environmental sensitive areas in the proposed project area. Further the small residential parks and road side trees, will not be affected, since the sewers are planned to be laid in the middle of the road and will not pass through these areas.	-
	Air quality	Probable increase in the dust levels (RSPM and SPM), during the construction may temporary deteriorate the air quality, causing health problems of respiratory ailments, leading cause for eye, ear, nose and throat infections and related discomfort.	Sprinkling of water at regular intervals to control dust especially places where soil is stockpiled and provision of top cover for vehicles involved in disposal of the excess soil material
	Noise levels	Increased noise levels due to construction activities like plying of construction vehicles, pumping machines, machinery such as cranes, riveting machines, hammering etc, may cause general disturbances to the human habitations like sleeplessness in case construction activity is extended into the night hours.	Providing curtains or sound barriers (polysheets/ sheets) all around the construction site. Proper maintenance of construction equipment and vehicles
	Water resources	Contamination of nearby water bodies via storm drains (during rainfall) by un-managed construction related material like suspended particles, pollutants like oil, grease, cement etc, There may also be temporary blockage of drains due to unmanaged material and construction debris	Suggestion to ensure proper handling and disposing off construction wastes at identified refusal sites. Proper stock piling of excavated soil and not in any storm drains or any other areas where water would naturally accumulate causing flooding.

Phase	Component	Key temporary Impacts	Key Mitigation Measures
Operation Phase	Noise and air quality	No air and noise problem from sewer line as they will be laid underground. Improper handling and irregular maintenance of operating machines at STP may lead to increased noise and odour nuisance during operation activity causing disturbance to surrounding human habitation	Proper handling and regular maintenance of operating machines at STP including pumps, generators, air diffusers, etc.
	Water environment	Water contamination and temporary flooding due to leakages/ overflows from the sewer lines may cause unhygienic condition	Regular monitoring of sewer line and STP. Suggestion to ensure appropriate repair work in less time period.
Social			
Construction	Livelihood	No impact, as there will be no impact on livelihood of any permanent shop-owners, licensed kiosks	But suggested if noticed during construction, then should be compensated according to ESMF
	Land acquisition	No impact, as no fresh land is required for any construction	-
	Inconvenience to public	There will be some minor inconveniences to the public due to construction like access to their premises, etc.	Public notice to be circulated, construction should be completed in the given time, debris should be cleared in time
	Health issues- due to dust, noise pollution	During construction dust and noise generated, can cause nuisance to people especially elderly and children, but impact is very limited.	Use of acoustics and water sprinkling

These temporary impacts can be mitigated with appropriate mitigation plans, which have been suggested as well, along with monitoring and evaluation of future projects. A lump-sum cost of probable environmental management plans, which were not a part of DPR was estimated to be approximately Rs. 1.24 crore which is about 0.25% of overall proposed project cost.

However, keeping in view, the temporary disruptions and impacts, it was concluded that the larger environmental value of the project greatly outweighs them. The project is expected to benefit the Patna City, as the wastewater that currently flows untreated into the Ganga river will be captured, treated and the remainder of the treated effluent will be allowed to flow into the river.

1.0 INTRODUCTION

The river Ganga is one of the prime rivers of India and is declared as the National River of India. The river Ganga has significant economic, environmental and cultural value in India. It flows east through the Gangetic plains of Northern India into the country of Bangladesh. It is the second largest river in the World by discharge. The Ganga Basin which is the largest river basin of the country houses about 40% population of India. The Ganges basin houses over 400 million people and a population density of about 390 inhabitants per square km. The river has immense religious significance and considered as the holy river of the Hindus. Historically too the river is important as many important cities and capitals have been located along its banks. The major cities along the River Ganges are Haridwar, Moradabad, Rampur, Allahabad, Kanpur, Patna, Varanasi and Rajshahi. The Ganges forms its Delta at the Bay of Bengal. The Ganges travels a distance of 2500 km beginning from the point of origin till she ultimately merges into the ocean.

Despite its importance, extreme pollution stress from increasing population and industrialization pose a great threat to the biodiversity and environmental sustainability of the Ganga, with detrimental effects on both the quantity and quality of its flows. During the course of its journey from the hills to the sea, municipal sewage from large urban centres, trade effluents from industries and polluting waste from several other non-point sources are discharged into the river are the main cause of its pollution.

The Ministry of Environment and Forests (MoEF), GoI has been implementing an ambitious programme of pollution abatement of rivers in India. It started in 1985 with the Ganga Action Plan (GAP). The main objective of GAP was to improve the water quality of Ganga to 'bathing class' standard by preventing the pollution load reaching the river.

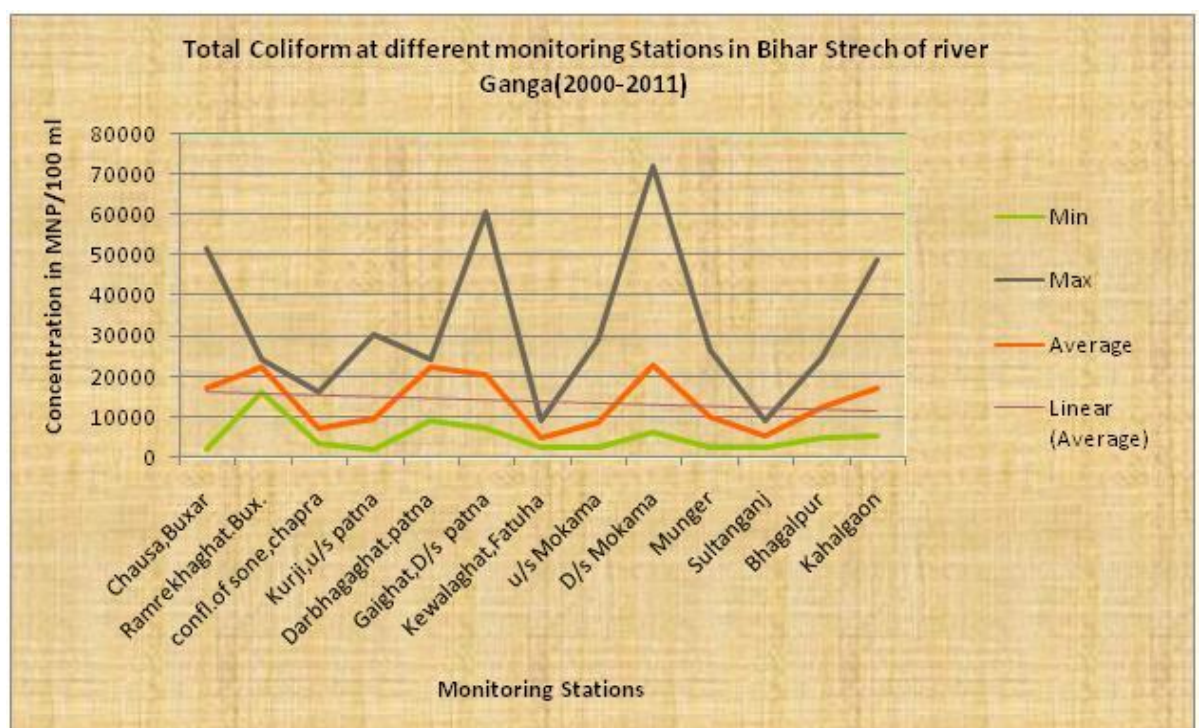


Figure 1-1: Total Coliform at different monitoring station in Bihar Stretch of River ganga (source: http://bhenvi.nic.in/water_quality.html)

To give a fresh impetus to pollution abatement of River Ganga and its tributaries, a major initiative under the National Ganga River Basin Authority (NGRBA) has been started. The current programmes include treatment of municipal from large urban centres before municipal sewage find its way into the river. Following approaches have been adopted for effective implementation of river-Ganga-cleanup-activities:

- Establishing a basin-level, multi-sectoral framework for addressing pollution in the river (including national/state policies and river basin management institutions);
- Making relevant institutions operational and effective (e.g. with the capacity to plan, implement and manage investments and enforce regulations); and,
- Implementing a phased program of prioritized infrastructure investments (with emphasis on sustainable operations and mobilization of community support)

1.1 The Ganga River Basin Project

The Government of India (GoI) constituted the National Ganga River Basin Authority (NGRBA), on 20th February 2009, for the comprehensive management of the river. The NGRBA is a planning, financing, monitoring and coordinating body of the centre and the states. The Authority has both regulatory and developmental functions. The NGRBA will adopt a river-basin approach and has been given a multi-sector mandate to address both water quantity and quality aspects. The Authority will take measures for effective abatement of pollution and conservation of the river Ganga in keeping with sustainable development needs which includes:

- Development of a river basin management plan;
- Regulation of activities aimed at prevention, control and abatement of pollution in Ganga to maintain its water quality, and to take measures relevant to river ecology and management in the Ganga basin states;
- Maintenance of minimum ecological flows in the river Ganga;
- Measures necessary for planning, financing and execution of programmes for abatement of pollution in the river Ganga including augmentation of sewerage infrastructure, catchment area treatment, protection of flood plains, creating public awareness;
- Collection, analysis and dissemination of information relating to environmental pollution in the river Ganga;
- Investigations and research regarding problems of environmental pollution and conservation of the river Ganga;
- Promotion of water conservation practices including recycling and reuse, rain water harvesting, and decentralised sewage treatment systems;
- Monitoring and review of the implementation of various programmes or activities taken up for prevention, control and abatement of pollution in the river Ganga;
- Issue directions under section 5 of the Environment (Protection) Act, 1986 for the purpose of exercising and performing these functions and for achievement of its objectives.

Building on the high-level dialogue with GoI on Ganga, The World Bank has been formally requested to provide long-term support to NGRBA, through several phases of substantive financing and knowledge support. The initial emphasis of the specific investments under the first project will focus on main stem of Ganga flowing through five basin states of Bihar, Jharkhand, Uttar Pradesh, Uttarakhand and West Bengal. Specifically, pollution abatement programs in cities on the banks of these States which would include a range of municipal investments such as sewer networks, waste water treatment facilities, industrial pollution control measures, river front management and solid waste disposal in the river through improved management in these cities and other required supportive improvements. This is expected to be enabled through several phases of substantive financing and knowledge support. The first project of such several phases of support aims at:

- i) Establishing and operationalizing central and state level NGRBA institutions capable of planning and implementing a multi sectoral river water quality improvement program and;
- ii) Reducing pollution loads into the river through selected investments.

The activities financed under this component are grouped under the following sub-components:

- (a) Sub-component A: NGRBA Operationalization and Program Management
- (b) Sub-component B: Technical Assistance for ULB Service Providers
- (c) Sub-component C: Technical Assistance for Environmental Regulators

a. Sub Component A: NGRBA Operationalization and Program Management

This sub-component is aimed at supporting the nascent operational institutions established for implementing the NGRBA program at the central and state levels on a full time basis. Key NGRBA program management activities included under this sub-component are described below :

- (a) Enhancing Ganga Knowledge Resources
- (b) Communications and Public Participation
- (c) Innovative Pilots
- (d) Program of Action for Carbon Credits

b. Sub component B: Technical Assistance for ULB Service Provider

The long term operation and maintenance of the NGRBA-funded assets is the responsibility of the ULBs and local service providers, and this sub-component is aimed at providing assistance that can gradually enable them to take on their role.

c. Sub-component C: Technical Assistance for Environmental Regulator

This sub-component is aimed at addressing the key constraints faced by the CPCB and SPCBs related to their functions regarding the Ganga. The subcomponent will support:

- (a) Capacity building of the CPCB and SPCBs
- (b) Up-gradation of Ganga Water Quality Monitoring System

1.2 Purpose and Scope of EIA

The present project will be implemented by NGRBA and for that assistance has been sought from World Bank. According to screening study and as per NGRBA's framework the project falls under high impact category and hence an EIA study is required along with specific EMP.

The scope of the EIA study has been finalized based upon the project screening and categorization and is given below:

- Project screening and scoping;
- Project categorization considering the OP: 4.01 (Environment Assessment);
- Assessment of existing sewage disposal and proposed improvement mechanism for restricting sewage and other trade effluent disposal;
- Detailed assessment of natural habitats in and around the project site;

- Assessment of air and noise quality in the vicinity of the project area ;
- Assessment of water quality along the river stretch;
- Preparation of study area maps for an immediate vicinity of 5 km from of the project site.
- Assessment of physical and cultural Resources along the project stretch and assessment of potential beneficial and adverse impact on such resources from the project;

1.3 Structure of the Report

This report deals with the Environment Assessment with Management Plan for the Sewerage works for Saidpur Zone, Patna. It rolls out the baseline status of the existing sewage situation and analyzes the situation if the proposed project is implemented, with its possible implications and to negate those implications management plan is advised which is as per the Environment and Social Management Framework. The present EIA report has been arranged in following chapters:

Introduction
This chapter describes briefly describes the project, Portfolios of Investments, the ESMF and need of EIA study
Project Description:
Project description is discussed pertaining to the proposed sewerage project Saidpur Zone of Patna. This chapter provides insight into the various component of the proposed project and briefly discusses about the previous projects attempted for River Ganga in Patna.
Policy, Legal and Administrative Framework
This Chapter captures the policy and legal framework of government of India as well the policies of World Bank that are applicable to the project.
Description of Environment
Description of the baseline environmental condition including the baseline conditions of river water quality, terrestrial and aquatic ecology, air, noise and soil quality are briefly described in this chapter.
Analysis of Alternative
This chapter describes the alternatives considered in the project towards improving the project.
Public Consultation
This chapter briefly describes the consultation measures carried out with the various sections of common public in and around the project area and the suggestions provided under the consultation are documented.
Environmental Impacts and Mitigation Measures
This chapter provides details of the potential impacts from the project on various environmental factors and mitigation measures proposed for the construction and operation stage
Environmental Management Plan
This chapter envisages the requirement of Environmental Management Plan including the monitoring and supervision framework for the implementation of EMP along with the budget for implementing EMP
Conclusion and Recommendation
This chapter provides the conclusion about the implementation of the project and provides necessary recommendations

2.0 PROJECT DESCRIPTION

2.1 About the City

Patna city lies on the 25°20' North latitude and 85° 03' East longitude. Patna is the capital of the Indian state of Bihar and the second largest city in Eastern India (in terms of population). Patna is one of the oldest inhabited & civilized places in the world. Ancient Patna, known as Pataliputra, was the capital of the Magadha Empire under the Haryanka, Nanda, Mauryan, Sunga, Gupta, Pala and Suri dynasties. Patna is located on the south bank of the Ganga River. A characteristic of the geography of Patna is its confluence of rivers. The Ganga River is the largest. It is joined by four other rivers: Ghaghara, Gandak, Punpun and Sone. Patna is unique in having four large rivers in its vicinity.

The modern city of Patna is situated on the southern bank of the Ganges. Patna is approximately 25 km long and 9 km to 10 km wide. The city has grown up gradually from the ancient age with the name 'Pataliputra'. It is located between the river Ganges in the North, the river 'Pun Pun' in the South and the river 'Sone' in the west. The geographical location of the Patna Urban Area is on the southern bank of River Ganges between latitudes 25°30'N & 25°40'N and longitudes 85°0'E & 85°-15'E. It is the 14th most populous agglomeration in India and 168th in the world with a population of approximately 1.8 million. It is the second largest city in eastern India, after Kolkata. Today, all major industries have a base in Patna reflecting the growing importance of the city. There has been significant enhancement in GDP of Bihar in the last decade. The growth of economy, urbanization & population trends are indicators that city shall continue to develop rapidly in next two-three decades. It is also fast emerging as a hub of higher education with institutes of national repute being started in Patna. The modern city of Patna is situated on the southern bank of the Ganga. The city also straddles the rivers Sone, Gandak and Punpun. The city is approximately 25 km long and 9 km to 10 km wide.



Figure 2-1: Clockwise from top: Budha Memorial Park, Takht Sri Patna Sahib, Patna Museum, and Martyr's Memorial Patna

2.2 Existing Sewerage Facilities in Patna City

Bihar is an important state from the perspective of Ganga Action Plan as a total of 445 km (almost 18%) of its total length of 2525 kms flow through the state. Whereas length of Ganga river flowing adjacent to Patna is around 30 kms. The recent survey of Class I and Class II cities indicated that about 8250 MLD of wastewater is generated in the Ganga basin out of which treatment facilities are available only for 3500 MLD of wastewater. A summary of total waste water discharged directly and indirectly into the Ganga River is presented in table below:

Table 2.1: Disposal of Wastewater in Ganga Basin, From Class-I and Class-II Towns in Bihar¹

State	Amount of waste water directly discharged into the Ganga from class I cities and Class II towns (MLD)	Amount of waste water directly discharged into the tributaries and sub tributaries of the Ganga from class I cities and Class II towns (MLD)	Amount of waste water discharged on land/low lying areas from class I cities and class II towns (MLD)	Total wastewater (MLD) disposal in Ganga basin
Bihar	412.1	171.5	87.8	671.4

The sewerage system in Patna was established in 1936. The city has four sewage treatment plants located at Saidpur (45 MLD), Beur (35 MLD), Pahari (25 MLD) and Karmali Chak (4 MLD). Coverage Area of various Zones is as tabulated below:

Table 2.2: coverage area of various sewerage zone

Zone	Digha Zone	Beur Zone	Saidpur Zone	Pahari Zone	Karmali Chak Zone
Area, km ²	26.49	19.51	27.38	21.62	7.53

The different sewerage zone of the Patna city is presented in the Figure 2-2. But the recent surveys conducted by CPCB revealed that there is huge infrastructural gap in installed capacity and treatment capacity for the Patna City around the year 2001 as tabulated below:

Table 2.3: Sewage pollution Load of Patna City (sewage disposed off in the river Ganga)²

S. No	City	Population (2001 census)	Total Sewage, MLD	Capacity of STPs, MLD	Capacity GAP, MLD	Percent Treatment Capacity
01	Patna	1366444	249.2	109.0	140.2	43.7%

The above table reveals a gap of 140.2 MLD in treatment capacity but on site surveys revealed that the installed treatment plants are not running on their design capacities due to:

- Lack of flow in absence of sufficient sewer length,
- Power shortage,
- Shortage of skilled and unskilled labour and Paucity of funds.

¹ <http://www.cpcb.nic.in/newitems/8.pdf>

² http://cpcb.nic.in/upload/NewItems/NewItem_168_CPCB-Ganga_Trend%20Report-Final.pdf

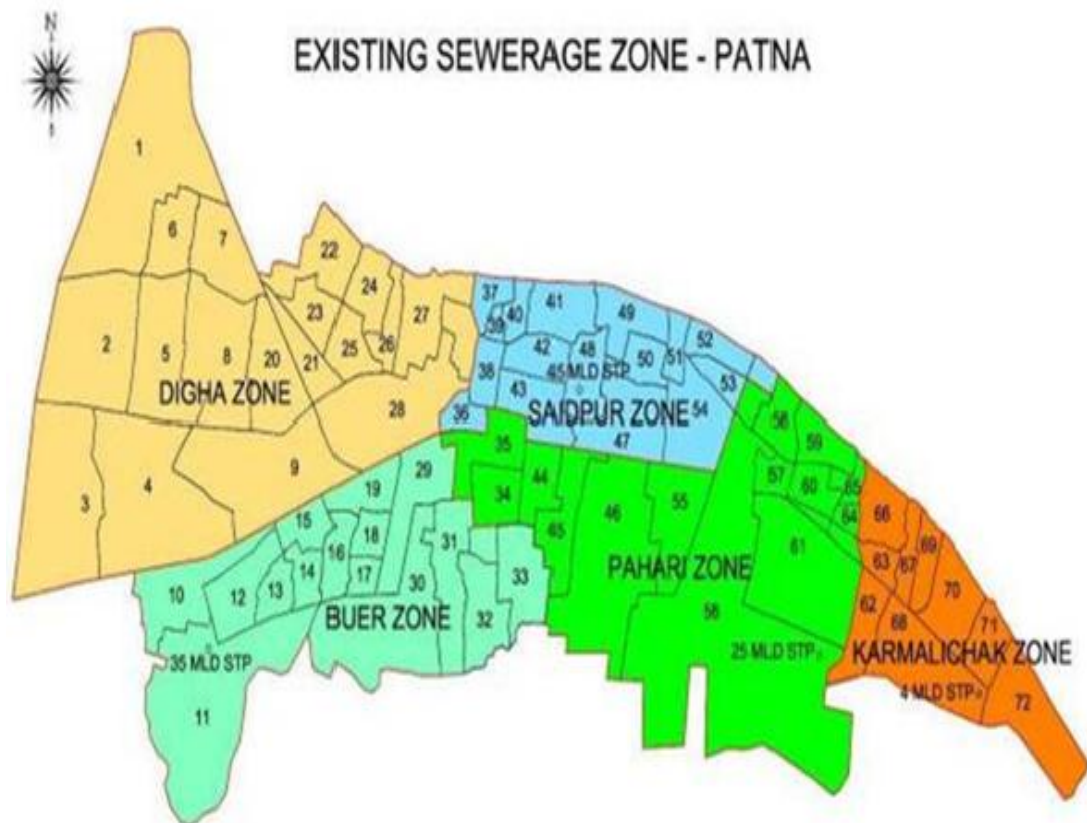


Figure 2-2: Existing Sewerage Zones in Patna Municipal Corporation

Moreover, the quantum of sewage reaching the plants is lower than installed capacity since majority of the city is uncovered by sewer network. Inhabitants living in area without sewer network have to rely on either decentralised collection system in form of in-house septic tanks or on unhygienic open defecation practice. Only 20% of the total households in PUAA are covered with underground sewerage system. The installed capacities of Sewage treatment plants is 109 MLD, but are receiving approximately 61 MLD of sewage, as the existing scheme requires renovation/ maintenance to run the STPs at their installed capacity. Figure below depicts the existing sewerage network (Shown by yellow lines on the map).

Further the existing sewers have outlived their design life and suffer from insufficient hydraulic capabilities, heavy silt deposition, severe choking due to ingress of solid waste and poor structural conditions in most of the stretches

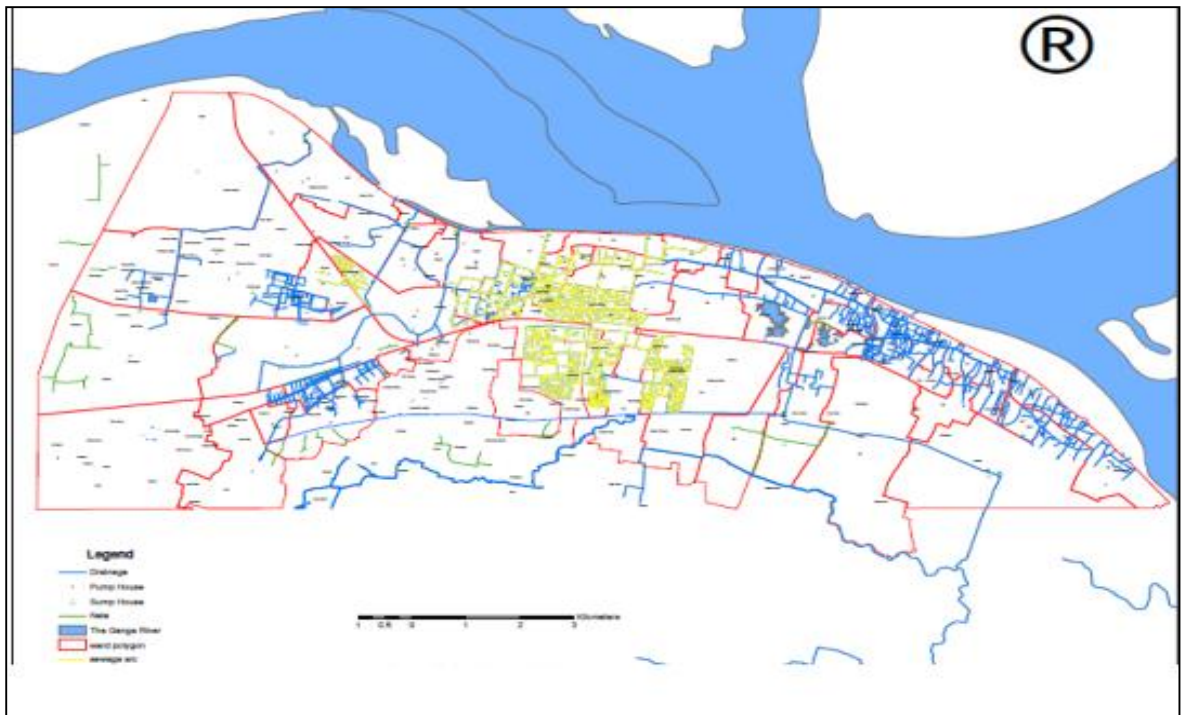


Figure 2-3: Existing sewerage and drainage network in the city³



Figure 2-4: Wastewater discharged behind the house.

2.3 Works Completed under Ganga Action Plan Phase – I (GAP-I)

With the objective of pollution to improve the river water quality and to reduce the environmental degradation, Ganga Action Plan was launched in 1985 by Ministry of Environment & Forest, Government. of India. The main focus of the Plan was on Interception & Diversion and treatment of sewage through 261 schemes spread over 25 Class I towns of U.P., Bihar and West Bengal. Bihar is an important state from the perspective of Ganga Action Plan as a total of 445 km (almost 18%) of its total length of 2525 kms flow through the state. Whereas length of Ganga river flowing adjacent to Patna is around 30 kms. Bihar being an important stretch from the perspective of Ganga Action Plan received attention in the very first Phase of the scheme and received considerable aid for establishing treatment facilities across the stretch. Table below provides the status of various facilities established under Ganga Action Plan (Phase-I).

³ Bihar Remote Sensing Application Center

Table 2.4: Sewage Treatment Plant Capacity under Ganga Action Plan Phase-14

Town	No. of STPs	Capacity (MLD)	Capacity Augmented (MLD)	Revised Sanctioned Cost (Rs. In lakh)
		Old	New	
Patna	STP-I	--	4	151.93
	STP-II	28	17	449.15
	STP-III	20	15	374.97
	STP-IV	--	25	395.41
Total	4	48	61	1371.46

2.4 Existing Sewerage Facilities for Saidpur Zone Patna City

This zone covers the central part of Patna City. The old Saidpur Zone of Patna as per the existing sewerage scheme is now divided in two zones namely Zone -III & IV A(N). As per new designation of Zones, it covers mostly the same the area of old Saidpur zone except Digha zone on east side. This zone have a STP within its boundary at Saidpur STP (45 MLD plant) site.

2.4.1 Existing STPs Scenario:

At present Saidpur zone has an existing ASP based STP capacity of 45 MLD which is catering a load of 33 MLD with primary level of treatment. Some of the reasons for the lesser inflow are improper maintenance of the sewer network due to siltation, dumping of refuse, debris, damaged pipes and manholes for want of repair and maintenance of STP. The existing condition sewerage system as well as STP of the saidpur zone has been shown in the following figures.



Figure 2-5: Photographs showing condition of Sewerage System of Saidpur Zone



Figure 2-6: the aeration tank (left) and inlet screen (right) of Saidpur STP.

The ultimate population for Zone-III & IV A(N) is projected as 4.02 lacs, 5.40 lacs & 6.93 lacs for years 2017, 2032 & 2047 respectively. On the basis of population projections for immediate (year 2017), intermediate (year 2032) and ultimate (year 2047), sewage generation from this zone is calculated at 48.23 MLD, 64.78 MLD and 83.11 MLD respectively.

With the present population (2017) of 3.64 lacs which generates sewage discharge of 43.69 MLD, open drains are acting as sewers during the dry weather flow. Whereas, in the monsoon, the same infrastructure is serving the dual purpose i.e. as sewers and drains. Thus making the situation worst for the local public. It is noteworthy that at most of the places/ localities, all households are discharging their sewage/ sullage through open drains into the nallas. The situation is further aggravated as all the solid waste is also being disposed off into these public drains. Due to the encroachment and dumping of solid waste causes silt deposition, the solid waste does not only obstruct the flow but due to the putricible organic matter present in sewage/ waste (which is biodegradable), causes septic condition resulting in foul odour and fly nuisance making the surrounding highly unhygienic. In addition to the same, the solid waste settles into the drains causing siltation which further have reduced the carrying capacity of drains. Water logging in open/ low lying area is a common phenomenon in the city.

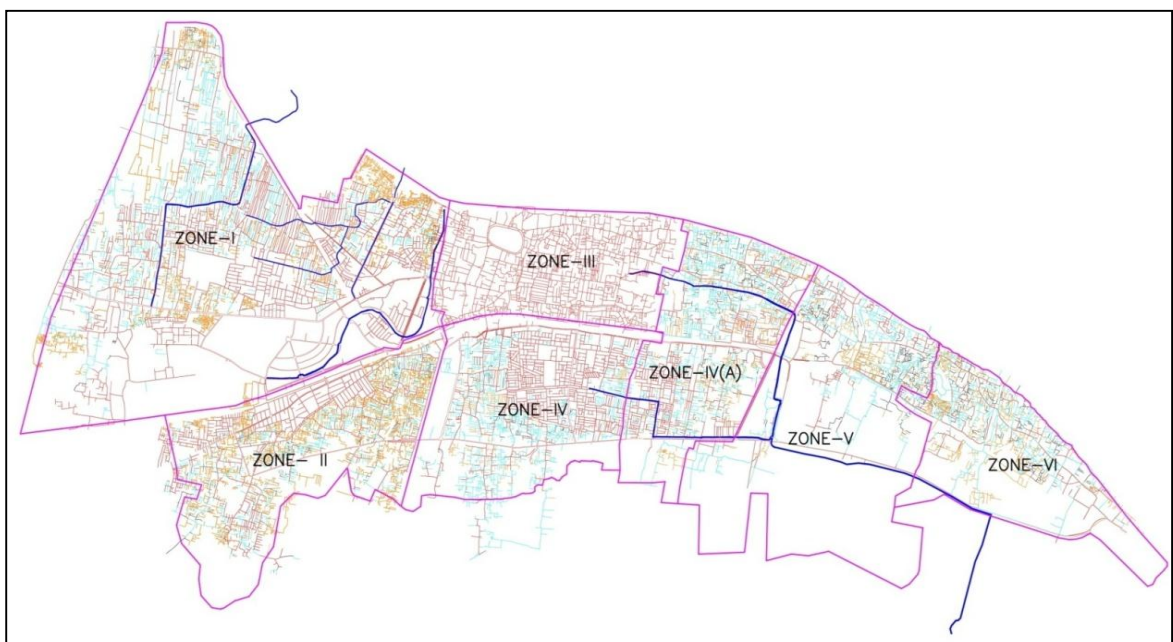


Figure 2-7: Area divisions as per new zoning plan

2.5 Necessity of this project

As per the recent surveys conducted by CPCB revealed that there is huge infrastructural gap in installed capacity and treatment capacity for the Patna City around the year 2001 as tabulated below:

Table 2.5: Sewage pollution Load of Patna City (sewage disposed of in the river Ganga)

S.No	City	Population (2001 census)	Total Sewage, MLD	Capacity of STPs, MLD	Capacity GAP, MLD	Percent Treatment Capacity
01	Patna	1366444	249.2	109.0	140.2	43.7%

2.5.1 Urbanization and Population Growth

Patna city is experiencing growth with corresponding increase in economic and commercial activities. There is influx of population both floating and fixed. The fixed load is due to additional settlements in the city and floating load is due to various business related people visiting the city. The already inadequate infrastructure is unable to bear the pressure of increased institutional and commercial activities.

The population growth experienced so far is expected to continue strongly over the next couple of decades adding more pressure to the already grossly inadequate sewerage system. Absence of timely action may result in contamination of existing surface and underground sources of water supply for the urban population of Patna city. For these reasons, it is imperative that an efficient and effective sewage collection, treatment and disposal system complimented by a good storm water drainage system be quickly installed to allow Patna to meet the health and sanitation needs of the population and to prevent the lack of infrastructure from hampering economic growth. (PMC is having responsibility for proper operation and management of the sewerage, drainage and solid waste handling systems).

With growing urbanization and emergence of urban areas as growth centres combined with improved living standards, it is necessary for any city to provide an efficient Infrastructure service be in the field of water supply, sewerage & sanitation and storm water drainage. The efficiency of drainage of rain water largely depends on provision of a well designed network of drains and if need be along with a number of Pumping stations. The census data on decadal population since year 1951 is presented in Table 2.6:.

Table 2.6: Decadal Population Data for Patna City

Sr. No.	Census year	Population	Average Decadal Growth Rate(%)
1	1951	283,000	--
2	1961	365,000	29
3	1971	473,000	30
4	1981	776,371	64
5	1991	917,243	18
6	2001	136,6,444	49
7	2011	168,3,200	24

Source: Census India website, 2011

As per the estimate made in DPR the final population growth will be around 46 lakhs. The population projection is summarized in the table below:

Table 2.7: Summary of the Population Projection (Final Revised)

Year	2013	2017	2028	2032	2047
Population	18,90,455	20,99,058	27,70,400	30,85,217	45,68,410

2.5.2 Saidpur Population Projection

The final population for year 2017, 2032 & 2047 is distributed in Zones as per ward boundary and area falls under it. The same is tabulated below to overview the project:

Table 2.8: Population Projection of Saidpur Zone

Sr. No.	Zones	2017	2032	2047
1	Zone - III [incl. Zone IVA (N)]	4,01,948	5,39,894	6,92,606

It is also noteworthy that significant areas are still lowly populated. Moreover with no space for growth in north & east, bulk of growth potential is in southern region of Patna hence good infra facilities shall give boost to the development.

2.5.3 Project Components:

The project has been divided into three sub-projects namely:

- Saidpur STP of 60 mld;
- Sewerage network in Zone-III + Sewerage Network in Zone-IV (N) = 172.50 km
- Saidpur STP Area- 55.10 Km

Location of the sub projects are shown in figure 2.8, 2.9, 2.10 respectively.

A 60 mld STP has been proposed at Saidpur to cater the sewage load up to 2032 from Saidpur sewerage. Typical components of STP considering SBR based technology will consists of following units (though this will be firmed up during detailed design stage):

- Fine screen channels
- Grit removal units
- Anoxic basins
- SBR basins
- UV based disinfection
- Sludge sump and pump house
- Sludge thickner
- Thickened sludge sump and centrifugal feed pumps
- Sludge Dewatering system
- Air blower room
- Laboratory/ SCADA building
- Staff quarters

This STP will meet the following desired sewerage quality:

Table 2.9: STP's desired sewerage quality

S.No	Characteristics	Unit	Rang (Gram /cap / day)	Typical Value
1	pH	--	7-10	7-10
2	Colour	--	Grey ,light brown	-
3	Odour	--	Soapy Oily	-
4	BOD5	(mg/l)	45-54	45
5	COD	(mg/l)	1.60-1.90 of BOD5	1.60-1.90 of BOD5
6	Total Solids	(mg/l)	170-220	190
7	Suspended Solid	(mg/l)	70-145	90
8	Grease	(mg/l)	10-30	10
9	Alkalinity	(mg/l)	20-30	25
10	Chlorides	(mg/l)	4-8	6
11	Total Nitrogen	(mg/l)	6-12	9
12	Total phosphorus	(mg/l)	0.60-4.50	2.25
13	Microorganisms coli forms, bacteria, virus etc)	No/l	102-1010	106

The STP shall be designed in such a manner that sludge is fully digested and can be used as manure.

2.6 Location of Proposed Sewerage Project

PMC at present is sub divided into five sewerage zones namely; Digha Zone, Beur Zone, Saidpur Zone, Pahari Zone, and Karmali Chak Zone. Out of those five, Saidpur Zone lies at 25°36' North latitude and 85° 9' East longitude, located in the north central part of the city. The west side of this zone is bound by Mahatma Gandhi Maidan, Rajendra path, Bakerganj etc. The south side area of this zone includes Rajendra Nagar, Ghrounda, Delhi-Howrah railway line etc and on east side it has the area named Bhikhana Pahari, Lal bagh Sharif Colony etc. The north part is bounded by Ganga River. This zone covers about 13.77 sq. km. which is about 13.77% of project area.

There are totally 24 wards falling under this project area, and projected to have population of 4.02 lacs by the year 2017. The area is mostly residential with no industrial area and very less commercial area, which is very randomly distributed in the whole study area. At present the area partly covered with centralized sewerage system facility and the wastewater is treated in the existing STP of 45 kld.

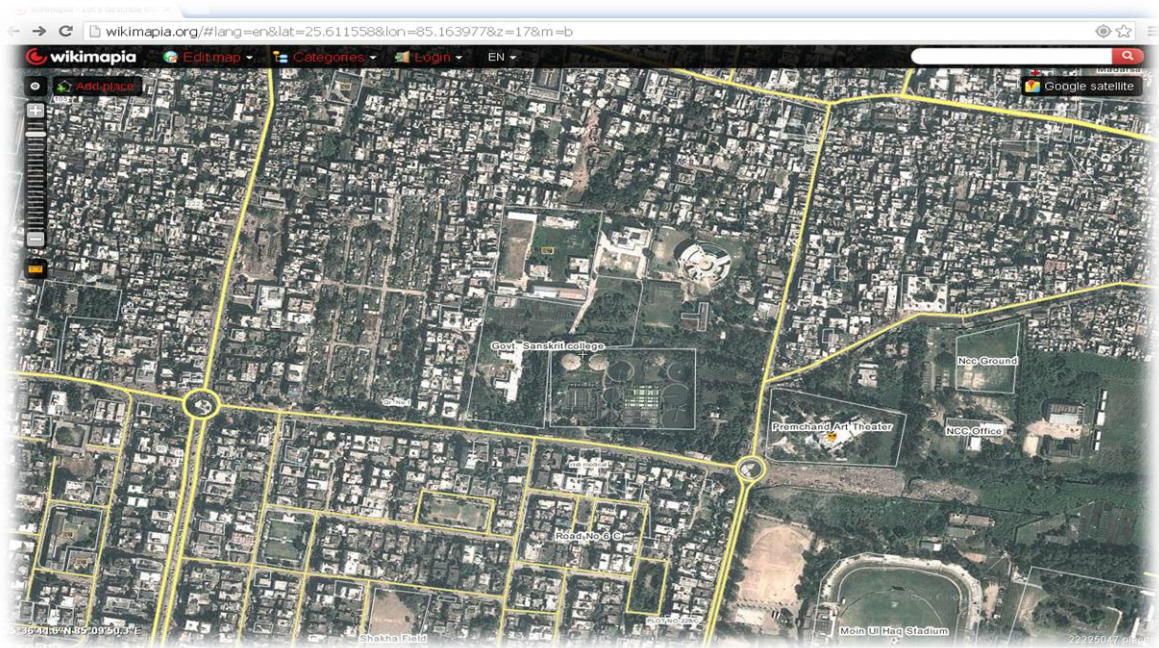


Figure 2-8: Google image showing Saidpur STP Area

2.7 Proposed Sewerage System

The Detailed project Report is being prepared. The proposed sewerage network in Saidpur as shown in

Figure 2-9: Proposed sewerage network of Saidpur STP Area.



Figure 2-9: Proposed sewerage network of Saidpur STP Area

2.7.1 Sewer System

- (i) Sewer Pipes: It is proposed to lay approximately 228 km long sewer network for Saidpur zone of the city. Size wise details are given in the Table 2.9 below.

Table 2.9: Size wise details of the sewers proposed for sewerage work in Saidpur Zone.

Sewerage area	Sewers Dia (mm)	Length (m)
Zone III	200-1600	132871

Zone IV	200 - 1600	94726.7
Total		227597.70 m say 228 km

- (ii) Sewage Pumping Stations: Sewage Pumping Stations: The Intermediate Sewage Pumping Stations (IPSS) are proposed at three locations in Zone - III to cater load of 5.18 lacs (design population). Similarly, an IPS at Arfabad location has been proposed for Zone- IV A(N) to cater a load of 24.66 MLD. These IPSs are so placed that the depth of sewers through the zone restricted to 6.0 m generally. The location of sewage pumping stations has been shown in figure below

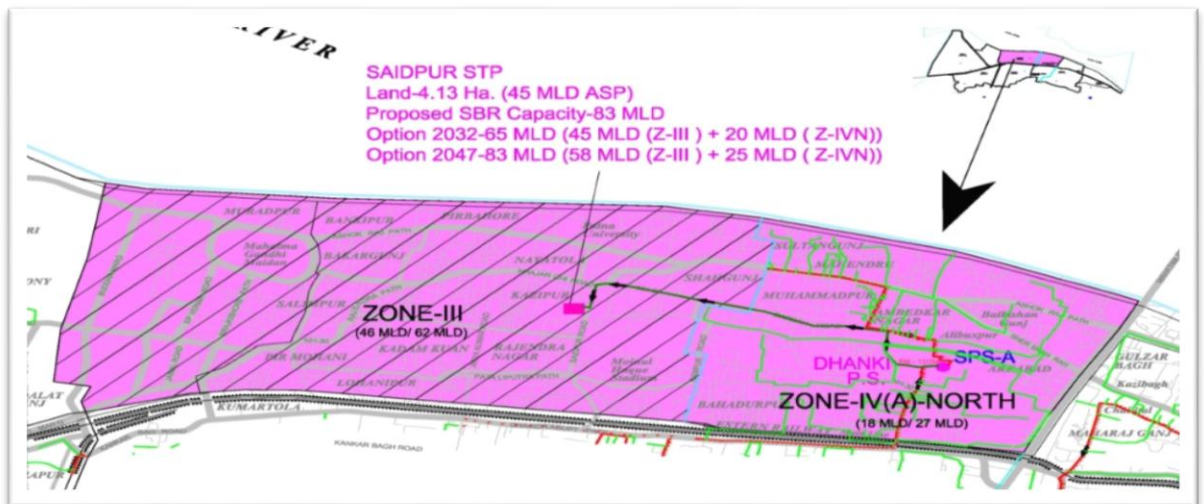


Figure 2-10: location of sewage pumping stations

Table 2.10: Summary of proposed and Existing Sewage Pumping stations in Saidpur Zone

Zone	Sub Zone	Sewage Generation (MLD)			Proposed SPS Capacity (MLD)	Location of Proposed SPS	Proposed length of Rising main, m
		2017	2032	2047			
III	SPS A	5.41	6.72	9.01	9.01	Exhibition Road	961
	SPS B	6.26	7.76	10.35	10.35	Pirmohani	745
	SPS C	2.73	3.38	4.30	4.30	Kadamkuan	264
IVA-N	SPS A	15.65	20.21	24.66	24.66	Arfabad Area	2880
(At STP)		48.23	64.78	83.11	83.11	MPS	

- (iii) Manholes: the ordinary circular manholes of brick masonry are proposed at all junctions, change of diameters, and change in pipe gradients and on straight run of sewer. Drop manholes are proposed where the difference between invert level of lateral/ branch sewer and maximum water level (at design peak flows) of main sewer is more than 600mm. Scraper manholes are proposed for sewer diameter greater than 450mm at interval of about 150m to facilitate lowering of equipment for cleaning purpose.
- (iv) House connection: Laterals are proposed along the roads to connect sewage from individual houses and it is connected to branch sewers. House connections for whole project are proposed to be executed by or before 2019 end in phase wise manner.

2.7.2 Renovation and Augmentation of existing Saidpur STP

Sewage Treatment Plant (60 MLD by the year 2032 & 83 MLD by the year 2047): SBR based STPs with provision of disinfection through UV are proposed. The STP will consists of following units:

- Fine screen channels
- Grit removal units
- Anoxic basins
- SBR basins
- UV based disinfection
- Sludge sump and pump house
- Sludge thickner
- Thickened sludge sump and centrifugal feed pumps
- Sludge Dewatering system
- Air blower room
- Laboratory/ SCADA building
- Staff quarters

2.7.3 Sewer Cleaning Equipment

For proper maintenance of the sewerage system, provision has been made for one jetting cum suction machine, submersible dredger pump, safety equipment, and sewer cleaning machine of power bucket type. which will help to collect the sludge and will disposed on identified PMC waste disposal site regularly by packed tractor trolley, mounted tanker and other environmental friendly collection and disposal sources.

2.8 Construction Methodology:

2.8.1 Construction

Construction of sewers and its appurtenances, sewage pumping stations and sewage treatment plant shall be carried out using mechanized construction tools and equipments to achieve maximum output. Use of prefabricated material is encouraged to improve quality of works, simultaneously improving efficiency of construction schedule. Contract documents for the project are framed such that, it would be compulsory for the prospective bidders / contractors to present a detail write-up and oral presentation on the following aspects of construction.

- Methodology of Construction (Method Statement),
- Site Management,
- Construction Schedule,
- Environment & Traffic Management,
- Cash Flow Projections,
- Schedule of Deployment of Machinery & Equipments,
- Schedule of Labour Deployment,
- Deployment of Technical Staff with Qualification & Experience,
- Quality Assurance Programme,
- Time & Cost Saving devices, if any.

Major Problems in planning during construction & execution of Scheme:

- Most part of Patna is denser (average 300-500 PPH)
- Narrow internal roads which have been considered for sewerage planning would prove difficult during execution with conventional technique.
- High water table (generally 2-5 m throughout the city)
- Movement of traffic and provision of public convenience
- Obstructions during relocation of utilities & disturbance in other services

2.8.2 Excavation

Trenches shall be excavated to the specified depth below the barrel of the pipe. The excavation of trenches for pipelines shall be done mechanically using appropriate equipments. The proposed excavation at any one time shall be limited to such lengths, which does not cause inconvenience to surrounding inhabitants and road traffic.

All excavations left unattended shall be adequately protected with approved fencing and barricades and with flashing lights where required.

2.8.3 Placing and Compaction of Fill and Backfill

Handling, placing, spreading, compacting, wetting, trimming and quality control of fill material for compacted fill shall be as shown on the drawings or in accordance with the specifications. Fill shall be spread by manual / machine in successive horizontal layers of not more than 150 mm loose depth. Longitudinal or transverse joints in any two successive layers shall be staggered by a minimum distance of 3 m. Backfilling shall be done after successful hydro testing.

2.8.4 Disposal of Surplus Material

The surplus excavated material shall be disposed off at locations proposed on drawings (at construction stage), in an environmental friendly manner. Storing excavated material, whether temporarily or permanently, shall be subject to prior approval. Where required, drains shall be constructed to prevent the undesirable accumulation of water in or around spoil dumps.

2.8.5 Dewatering of Excess Water

During construction, ground and surface water shall be controlled to the extent that excavation and pipe installation can proceed in the specified manner and such that the trench bottom is not disturbed to the detriment of the pipe installation. Trench water shall not be permitted to enter the pipe being installed unless approval is received from the Engineer.

2.8.6 Shoring in Patna City

The total length of sewer line to be laid in the city is 1350 km and the depth of sewers varies from 1m to 6m in general. It is implied that such extensive sewer networks would necessitate extensive excavations and restoration of the excavated works, besides restoration of roads. The sewer laying is slow, time consuming process, wherein the degree of difficulty increases with the larger depths. In Patna the problem gets further compounded due to high water table and narrow lanes. In general a trench depth upto 1.5m can be excavated without provision of shoring. However, for depth greater than 1.5m, the trench walls are to be secured with timber shoring to prevent collapsing of side walls. Incidentally the Bihar Schedule of Rates only provision for timber shoring and thus in the detailed estimation and costing, consultant has considered the timber shoring.

2.8.7 Bedding

Granular bedding for pipes shall be placed by spreading and compacting granular bedding material over the complete width of the pipe trench. Where pipes are jointed, bell holes of ample dimensions shall be formed in the bedding to ensure that each pipe is uniformly supported throughout the length of its barrel and to enable the joint to be made and inspected during testing. After pipe laying additional material shall be placed and compacted by hand rammer in 150 mm layers equally on each side of the pipe. Pipes shall be laid on setting blocks only where a concrete bed or cradle is used

2.8.8 Trenchless Technology

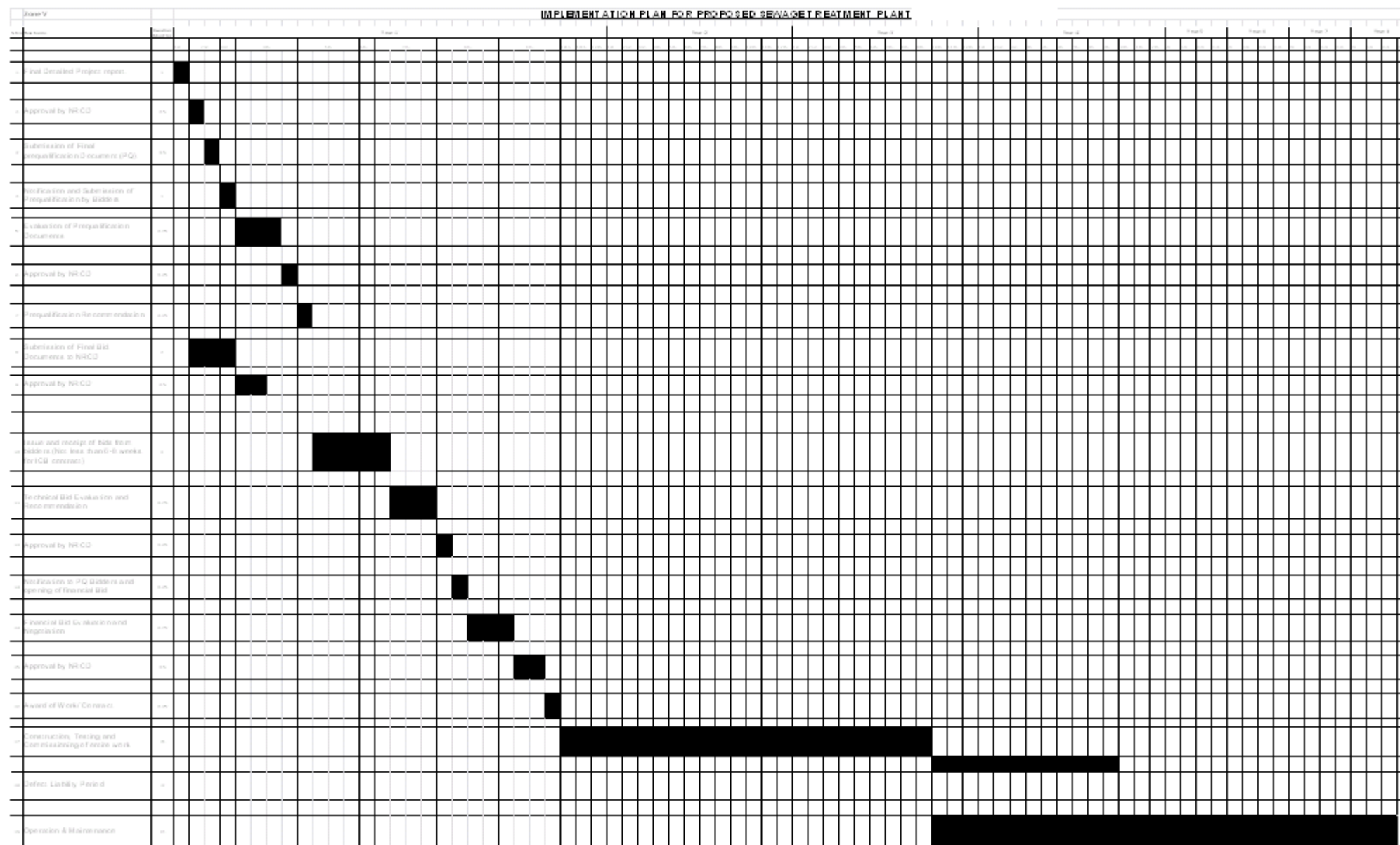
Trenchless technology, as the name implies, stands for subsurface construction works where fewer trenches or no continuous trenches are required to be dug. It is a rapidly growing sector of the construction and civil engineering industry. It can be defined as "A family of methods, materials, and equipment capable of being used for the installation of new or replacement or rehabilitation of existing underground infrastructure with minimal disruption to surface traffic, business, and other activities.

The most important advantages of trenchless technology can be summarized as follows:

- Road damage is minimized,
- Fast laying as no reinstatement of the surface is necessary
- No impact on residents and traffic in construction area
- No harmful impact on Environment or if have, very little
- No disruption of highway traffic thanks to little or no excavation
- No construction noise because these are no construction vehicles and construction activities as known with conventional open trench pipe-laying.

2.9 Implementation Schedule

It is anticipated that construction duration for the contractor is estimated to be 36 Months (including monsoon period) with O&M for next five years for proposed STP and sewerage system of saidpur village Patna. The operation and maintenance of proposed sewerage system is also considered for five years after commission of the system. The Implementation schedule is given in **Figure- 2.11**



2.10 Financing

Detailed Project Report (DPR) of the project under National Ganga River Basin Authority (NGRBA) programme amounting to Rs. 199.0 crore for the renovation and augmentation of STP and Rs. 279.0 crore for the laying of sewer lines. Table 2.8 and 2.9 gives the summary of cost of the proposed STP and sewerage work Saidpur zone of Patna.

Table 2.0.11: Abstract of Cost of Works Proposed STP

Sr. No.	Item	Civil & E/M Workers In Cost (INR Lakh)
1.	Construction of New Sewage Treatment Plants based on suitable technology (60 MLD for 2032) @ 1.5Cr/ MLD	9000
2.	Extra cost for disinfection through UV (11 modules @ 5.5 MLD/ Module)	165
3.	Sewer line contributing directly to STP, for 55.10 km (200-1600 mm diameter pipes)	4958
Sub Total A		14123
Items which on which no centage is admissible		
B1	Environmental Mitigation and Monitoring Cost (EMM Cost)	69
B2	Communication and Public Outreach 7 GAPP	12.5
Sub Total B		81.5
C1	Project Preparation Cost (Limited to maximum 4% of A as per NGRBA Programme Framework)	564.92
C2	Project Supervision Cost (Limited to maximum 4% of A) as per NGRBA Programme Framework)	564.92
Sub Total C		1129.84
D	Gross Capital Cost (A+B+C)	15334.34
E	Operation & Maintenance Cost	
E1	STP (@5% per annum)	2250
E2	UV Disinfection	165
E3	Sewer Network (3% per annum)	743.7
Total O & M Cost		3158.7
F	Project Total Cost (D+E)	18493.04
Say Rs. 184.93 Crores		
(Rupees One Hundred Eighty Four Crore and Ninety Three Lakhs Only)		

Table 2.0.12: Overall Estimated Project Cost for proposed sewerage system project

Sr. No.	Item	Estimated Cost (INR Lakhs)
A	Saidpur Sewerage scheme at Zone III + IV (N)	
1.	Sewerage system complete with laterals, collectors, interceptor & trunk sewers including Trenchless portion etc.	12945
2.	Construction of 04 Nos. of SPS	2200
3.	Total House Connections is 67000 nos	2573
4.	Relocation of Utilities	500
5.	Provision of boarding of Trenchless Sewers	4489
Sub - Total of A		22707
B	Charges	
1	Cost of Project preparation @ 4% as per NGRBA Programme guideline (maximum)	908.28
2	Cost of Supervision of project @ 4% as per NGRBA Programme guideline (maximum)	908.28
Sub - Total of B		1816.56
C	Cost of work where charges will not be admissible	
1.	Environmental Mitigation and Monitoring Cost	55.00
2.	Communication and Public Outreach	10.00
3.	GAAP	2.50
Sub Total of C		67.50
D	Operation and Maintenance	
1	5 years O & M Cost	2272
Sub Total of D		2272.00
Total Cost (A+B+C)		26863.06 Lakhs
Say		268.63 Crores

3.0 Approach and Methodology

3.1 Methodology

As per Environmental and Social Management Frame work (NGRBA, 2011)⁵, and considering associated environmental and social impacts, an environmental and social assessment with corresponding management plans for the proposed project of sewerage works in sewerage district 'A' of Allahabad City has been conducted using the following methodology:

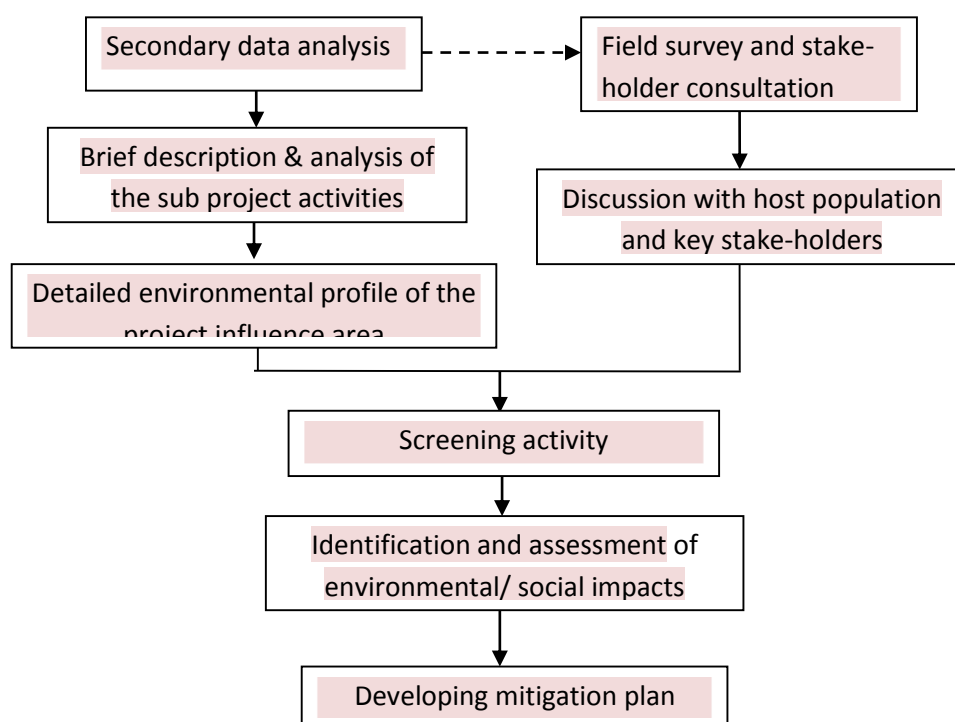


Figure: 3.1 Flowchart describing the steps adopted for Project Impact Assessment

- a) Secondary Data analysis (Identify Information/Data Requirements and their Sources): All the available information and data (quantitative, qualitative) regarding the proposed project was collected mainly from the Detailed Project Report (DPR), consultation with stake-holders and other secondary sources including the water/air/noise monitoring reports of UP Pollution Board, Water Quality Management Plan of Ganga River Report of Patna, City Development Plan of Patna and many others. Through this secondary information a brief description and analysis of the sub-project activities along with baseline environmental profile of the project influence was established. Based on initial understanding, the list of required information was drafted before conducting the field survey.
- b) Defining the project area and carrying out scoping in the field: Team undertook the field survey and transect walk of the sewerage district Patna area to develop the understanding of the proposed project (refer Plate 3.1, 3.2). GPS surveying of the study area was also conducted for mapping the social and environmental issue. Field visits helped to understand the local knowledge and were valuable in finding alternatives that help avoid or at least reduce the magnitude and severity of adverse impacts.
- c) And how it will affect them (after completion phase). Also they were asked about the mitigation plans they have adopted or are planning to adopt, suggestions for improvement and any public grievances. Surveys were conducted along the path of construction site. Survey of the host population: With the help

⁵ For more details refer "Environmental and Social Management Framework for World Bank Assisted National Ganga River Basin Project, 2011". PMG, National Ganga River Basin Authority, MoEF.

of questionnaires, local people were interviewed in groups. A wide range of potentially affected people were interviewed in Patna including street vendors, residents of households, residents of temporary settlements, shop keepers, hospital patients, hospital staff, etc. Both men and women were interviewed from different sections of the society. Team undertook three field visits to carry out the survey and understand the ground situation. The interviewees were asked about their awareness of the project, their response to it and if the project is affecting them (during construction phase)



Figure: 3.2- Public Consultation with local people.

- d) **Discussion with the key stakeholders:** Most of the interactions with important key stakeholders were through both informal and formal discussions with them. All the associated government departments were visited to collect the relevant data and their feedback on the project activities.
- e) **Conduct Screening:** Screening is undertaken in the very beginning stages of project development. The purpose of screening is to screen out “no significant impacts” from those with significant impacts and get a broad picture of the nature, scale and magnitude of the issues. Team conducted screening process using the screening checklist format provided in ESMF report of NGRBA, which is described in subsequent section.
- f) **Identify and assess the impacts:** Based on the analysis of the data gathered from field survey, stakeholder interaction/ consultation and secondary sources, issues related to the environmental and social sectors were been identified. The impacts so identified were compared with the existing baseline environmental and social condition of the study region. The impacts of the activities are mostly positive with few adverse impacts.
- g) **Develop a mitigation plan:** Based on the environmental and social issues identified, measures needed to prevent, minimize, mitigate, or compensate for adverse impacts and improve environmental performance were recommended. The mitigation plans is suggested in all three stages: designing phase, construction phase and, operation and maintenance phase.

3.2 Project Screening

Patna city covering an area of 100 sq.km is subdivided into 5 district zones (Digha, Beur, Saidpur, Pahari, Karmali chak). The Bihar Urban Infrastructure Development Corporation

(BUIDCo) based on topography and contributory population has divided the Patna city into six zones for complete sewerage system of the city. As per the new zoning plan the Saidpur Zone of Patna now covers two zones namely Zone –III & IV A (N). This zone forms the north- central part of city and covers 13.77% of total project area. The west side of this zone is bound by Mahatma Gandhi Maidan, Rajendra path, Bakerganj etc. The south side area of this zone includes Rajendra Nagar, Ghrounda, Delhi-Howrah railway line, etc. and on east side it has the area named Bhikhana Pahari, Lal bagh Sharif Colony, etc. The north part is bounded by Ganga River.

At present Saidpur zone has an existing ASP based STP capacity of 45 MLD which is catering a load of 33 MLD with primary level of treatment. The treated sewage is then pumped to the Rampur drains to Barmutta nala and finally leads to the Punpun river. The river Punpun on southern side flows parallel to the city and join river Ganga at 20 km away. As part of the study, a comprehensive water analysis of the water quality of river Ganga and river Punpun as well as inlet and outlet of the Saidpur STP has been performed through the Bihar State Pollution Control Board. The study found that the water quality of the river Ganga as well as river Punpun is severely polluted in terms of total coliform and fecal coliform and does not fit the water quality standard for bathing. Even the treated water quality from the Shaidpur STP does not meet the general discharge standards for inland surface water.

Table 3.1: Effluent Quality Report of STP At Saidpur

Parameter		General standard for discharge on inland surface water as per CPCB
BOD(mg/l)	46	30
COD (mg/l)	96	250
TSS (mg/l)	104	100

The ultimate population for Zone-III & IV A(N) is projected as 4.02 lacs, 5.40 lacs & 6.93 lacs for years 2017, 2032 & 2047 respectively. On the basis of population projections for immediate (year 2017), intermediate (year 2032) and ultimate (year 2047), sewage

generation from this zone is calculated at 48.23 MLD, 64.78 MLD and 83.11 MLD

respectively. Considering the density of population, absence of proper sewerage network, proximity to the Ganga river and the point of confluence, it becomes more important to provide sewerage and treatment infrastructure for the area. The major components of the proposed project include:

- 228 km long sewerage network including all required trunk/ branch/ lateral sewer.
- Augmenting Shaidpur STP of capacity to 60 MLD by 2032 and 83 MLD by 2047
- Operation and maintenance

As per DPR, the total cost for the sewerage lines and sewage treatment plant will be Rs. 279 crore and Rs. 203 crore respectively.

The project screening was carried out to understand the nature, scale and magnitude of environmental and social issues associated with the project. The screening activity was conducted as per the guidelines provided in Environmental and Social Management Framework of NGRBA (NGRBA, 2011) and on the secondary data analysis, field assessments and stakeholder interaction/ consultation. The detail of screening is summarized in the Table 3.1 below.

Table: 3.2 Project assessment of Categorization :

Sr. No.	Screening Criteria	Assessment of category (High/ low)	Explanatory note for categorization
1	Is the project in an eco-sensitive area or adjoining an eco-sensitive area? (Yes/No) If Yes, which is the area? Elaborate impact accordingly.	No	There are no environmental sensitive areas in the proposed project area. Further the small residential parks and road side trees will not be affected (particularly near Ashok Rajpath, Keshari Ghat, Saidpur Main road etc), since the sewers are planned to be laid in the middle of the road and will not pass through these areas.
2			
2.1	Land acquisition resulting in loss of income from agricultural land, plantation or other existing land-use.	No acquisition of land is required.	<ul style="list-style-type: none"> STP for Package -3 (65 MLD) has been planned to setup on existing available STP site at saidpur locations No squatters or encroachers in and around the premises who could get affected by the project. The consultant has proposed 03 IPSs for saidpur Package. Out of total 03 IPSs, no land acquisition is required.
2.2	Loss of livelihood	No	Loss of livelihood is not expected and since mobile vendors can change their location, there would be no loss. There could be minor disruption in terms of access to shops.
2.3	Land acquisition resulting in relocation of households.	No social impacts	<p>No Land acquisition required and no relocation of households required since identified plots of land do not have any habitations or settlements. Thus, no relocation of household require for this package.</p> <p>The locations of STP as proposed on exists site thus no habitation/ household relocation is required.</p> <p>Also there exist no squatters or encroachers in and around the premises which will be affected.</p>
2.4	Any reduction of access to traditional and river dependent communities (to river and areas where they earn for their primary or substantial livelihood).	No social impacts seems to have	No access problem likely to be there.
2.5	Any displacement or adverse impact on tribal settlement(s).	No social impacts seems to	There are no tribal settlements in the project area.

		have	
2.6	Any specific gender issues	No social impacts seems to have	No gender issues were reported during survey
3			
3.1	Clearance of vegetation/ tree-cover	No environmental impacts	<p>The tree/ vegetation cover in areas (Bhoothnath road, Gaighat road, Shershah road, Idgah road etc) are aligned along the road sides and will not be affected as the sewer lines will be laid in the centre of the roads.</p> <p>There will also be not any impact on the residential parks such Zoological park and some major talabs (Mangal Talab) in Zone –V & IVA(S).</p>
3.2	Direct discharge of construction runoff, improper storage and disposal of excavation spoils, wastes and other construction materials adversely affecting water quality and flow regimes.	Limited & Temporary	<p>Possibility of temporary flushing away of un-managed spoils and construction wastes during rainfall to river Ganga/ Punpun via storm water drains.</p> <p>If not appropriately managed, there may be potential for temporary effect on storm water flows by obstruction to flows and blockage of drains, especially during rainfall. This may cause floods.</p>
3.3	Flooding of adjacent areas	Limited & Temporary	<p>For sewerage works in the entire city, flooding could be an issue during the monsoons, especially in the congested regions like in and around Nandlal Chapra, Alibuxar, Alam gunj etc areas. This issue may further aggravate due to blocked drains and poor solid waste management in the city.</p>
3.4	Improper storage and handling of substances leading to contamination of soil and water	Limited & Temporary	<p>The storage of construction related material will not cause any contamination since these materials would typically include: Concrete, pipes, masonry, rubber pipes.</p> <p>The project area have a major water bodies i.e. Saidpur Nalla/ Pahari Nalla also some important ghats on Ganga to be picked up in RFD phase -2. However these areas will not be affected as sewer</p>

			<p>lines are not planned to be laid through any of these areas.</p> <p>However, with other finer materials such as construction powders, fluids and greases, if not appropriately managed or in the event of an accident, there may be potential for temporary contamination of the river Ganga via the various drains and nallas, during rainfall.</p> <p>If construction material will not be handled appropriately, it may affect agricultural lands minutely.</p>
3.5	Elevated noise and dust emission	Limited & Temporary	<p>For sewage works, construction is likely to increase dust and noise levels temporarily.</p> <p>Temporary impacts may especially be felt at educational facilities like schools/colleges (Litera Public School, Anand Paramedical College, Bhagwat Milan Mandir school, DAV School and hospitals (Nalanda Medical College & Hospital, RMRIMS etc), cultural/religious centers including all temples, mosques, churches and Gurudwaras in the region. Provided that construction works near schools and colleges are carried out during vacations and preferably during night and works near hospitals are completed on priority basis (in shorter time period with alternate provision of traffic, accessibility of exit/entry gates etc.), the impacts may be limited.</p>
3.6	Disruption to traffic movements	Limited & Temporary	<p>Traffic disruption can be expected in busy areas such as area around Bhoothnath road, Shershah marg, Saidpur Main road, Ashok rajpath etc area due to transportation of material of construction.</p>
3.7	Damage to existing infrastructure, public utilities, amenities etc.	Limited & Temporary	<p>If not appropriately managed, there may be potential for temporarily affecting the existing public utilities like water supply, telephone, electricity cables etc.</p> <p>However, in the proposed scheme, there is a proper relocation of all utilities like telecom, water line, electricity, etc is provisioned.</p>
3.8	Failure to restore temporary construction sites	Limited & Temporary	<p>From field visits and as per JNNURM project (Water Supply scheme) reinstatement of dismantled roads after</p>

			<p>filling and proper compaction was observed.</p> <p>Although temporary, concerns regarding failure to restore construction sites including failure to close and appropriately fence-off open pits were cited as safety concerns especially for children.</p>
3.9	Possible conflicts with and/or disruption to local community	Limited & Temporary	<p>For the laying of sewer works, there will be temporary disruption to the local community in terms of access to roads, (especially in dense areas and narrow roads), shops and residences.</p> <p>Conflicts/ disruption to local community was inferred as limited based on survey responses which indicated the community's ability to adapt to temporary disruptions, and their overall preference for the project.</p>
3.10	Health risks due to unhygienic conditions at workers' camps	Limited & Temporary	<p>This risk may occur if labour Camps are not planned as per defined guidelines.</p>
3.11	Safety hazards during construction	Limited & Temporary	<p>From field visits and as per Water Supply project practices for safety precautions such as fencing-off construction areas, sign posts etc. were observed.</p> <p>If not appropriately managed, there may be potential for temporary hazards such as injuries and damage to property hazardous traffic conditions during the construction phase.</p>
4			
4.1	Flooding of adjacent areas	Limited & Temporary	<p>Due to the construction of sewer lines, raw sewage that currently flows into the river and/ or overflows into the streets will now be routed to the STP. This will prevent flooding of open sewerage water into adjacent areas.</p> <p>However, accidental leakages during the operational stage may lead to flooding and possible contamination of groundwater. Additionally, overloading and blockage of sewage lines will also lead to backlogging of sewers and flooding of branch sewers.</p>
4.2	Impacts to water quality due to effluent discharge	No social impacts seems to have	<p>There will be a significant improvement in water quality due to effluent discharge being treated.</p>
4.3	Gas emissions	No social impacts	<p>There will be reduction in gas emissions from open sewage drains since the</p>

		seems to have	proposed sewage networks will be underground.
4.4	Safety hazards	No social impacts seems to have	There will be minimum safety hazards since the sewer lines will be underground.
5	Do projects of this nature / type require prior environmental clearance either from the MOEF or from a relevant state Government department? (MOEF/ relevant State Government department/ No clearance at all)	No clearance required	Project such as these have an overall positive impact for the environment and society. Hence no clearance would be required under the Environmental Impact Assessment Notification, 2006.
6	Does the project involve any prior clearance from the MOEF or State Forest department for either the conversion of forest land or for tree-cutting? (Yes/No). If yes which?	No clearance required	As the project is in urban provinces and does not require any forest land of tree-cutting, hence no prior clearance is required from relevant authorities (MoEF and State Forest departments) under the Forest (Conservation) Act, 1980.
7	Please attach photographs and location maps along with this completed Environmental Information Format For Screening.	Attached along with the report	
8	Overall Assessment	Low	The project involve 198 km of sewer lines, 3 pumping stations and one STP

3.3 Conclusion of Screening Activity

In order to facilitate effective management and mitigation of the any impacts arising from the proposed projects, the Environmental and Social Management Framework of NGRBA (Section # 4 of ESMF report, NGRBA 2011)⁶ has grouped the pollution abatement projects/ investments into the following two categories high and low

- **High:** Mainly include the sub-projects which are likely to have adverse impact on the environmental and social aspects of the project influence area (including land acquisition). This category projects will also include mandatory environmental clearance as per the EIA notification.
- **Low:** Projects which are likely to cause minimal or no adverse environmental impacts on human populations.

As per the screening checklist as given above the project does not involve any land acquisition in 3 SPS and an STP site. The propose sever network will be laid within the ROW and hence land acquisition is not required however temporary issues like disposal of excavated material, Safety and

⁶ For more details refer "Environmental and Social Management Framework for World Bank Assisted National Ganga River Basin Project, 2011". PMG, National Ganga River Basin Authority, MoEF.

access issues, utility shifting, noise and dust pollution, impacts on water and drainage line generally will associated with any kind of project.

As part of Construction plan very congested area of the city trenchless technology is proposed which will not disturb ready access to the existing ROW were as manual excavation of sewer trenches involve care shall be taken to construct that section in the evening / night time so that access is not disturb in addition restoration of back section is to be done on same way. Further contractor will need to submit and get approve detailed traffic diversion plan during construction.

Excavated material will mostly be used for back filling purpose based on their suitability. Debris are expected in low quantum after back filling and will be suitably transported and disposed off in same low lying area approved by the project Engineer.

For noise and dust pollution adequate measures has been given in EMP and these impacts are temporary in nature. Considering the above point and screening matrix the project is consider in the low impact category.

Based on the screening activity and the categorization of potential sub-projects of the NGRBP, the present project of Sewerage work in Sewerage District Patna City falls under low impact categories, which do not have any land acquisition. In view of the above, these projects would require preparation of an Environmental and Social Assessment, as part of the DPR, and implementation of Generic Safeguard Management Plan (SMP), relevant to the project.

Although there would not be any permanent negative or adverse environmental impacts, but will have temporary impacts like traffic blockages, dust, noise, safety hazards for pedestrians, possible interruption in commercial activity. These temporary impacts can be mitigated with appropriate mitigation plans. However, the large environmental benefit of the project greatly outweighs the temporary inconveniences.

4 REGULATIONS AND LEGAL FRAMEWORK

4.1 Applicable Laws and Regulations – Environmental

The following laws and regulations are applicable to the environmental and social aspects of the investments implemented under the programme:

- Policy and Regulatory Framework of Government of India (GoI)
- Environmental Policy and Regulations of the respective State Governments
- Legislations applicable to construction activities

i. Legal Framework of Government of India

The Government of India has laid out various policy guidelines, acts and regulations pertaining to environment. The Environment (Protection) Act, 1986 is umbrella legislation for the protection of environment. As per this Act, the responsibility to administer the legislation has been jointly entrusted to the Ministry of Environment and Forests (MoEF) and the Central Pollution Control Board (CPCB)/ State Pollution Control Boards (SPCBs).

ii. Key Environmental Laws and Regulations

The key environmental laws and regulations as relevant to the projects under the NGRBP are given in Table 4.1. The key environmental regulations can also be accessed at www.moef.nic.in/rules-and-regulations

Table 4.1: Environmental Regulations and Legislations

S. No	Act / Rules	Purpose	Applicable Yes/ No	Authority
1	Environment Protection Act-1986	To protect and improve overall environment	Yes	MoEF, GoI, DoE, State Gov. CPCB, SPCB
2	Environmental Impact Notification 14th Sep-2006	To provide environmental clearance to new development activities following environmental impact assessment	Yes	MoEF, EIAA
3	Municipal Wastes(Management and Handling) 2000	To manage the collection, transportation, segregation, treatment, and disposal of municipal solid wastes	Yes	MoEF, EIAA, CPCB, SPCBs
4	Coastal Regulation Zone(CRZ) Notification 1991 (2002)	Protection of fragile coastal belt	No	
5	The Land Acquisition Act (As amended in 1985)	Set out rule for acquisition. of land by government	Yes	Revenue Department State Government
6	The Forest (Conservation) Act. 1980	To check deforestation by restricting conversion of forested	Yes	Forest Department, State Government and

S. No	Act / Rules	Purpose	Applicable Yes/ No	Authority
		areas into non-forested areas		Ministry of Environment and Forests, Government of India
7	Wild Life Act 1972	To protect wildlife through certain of National Parks and Sanctuaries	No	Chief Conservator Wildlife, Wildlife Wing, State Forest Department and Ministry of Environment and Forests, Government of India
8	Air (Prevention and Control of Act, 1981	To control air pollution by controlling emission of air pollutants as per the prescribed standards.	Yes	SPCBs
9	Water Prevention and Control of Pollution) Act1974	To control water pollution by controlling discharge of pollutants as per the prescribed standards	Yes	SPCBs
10	The Noise Pollution (Regulation and Control) Rules, 2000	The standards for noise for day and night have been promulgated by the MoEF for various land uses.	Yes	SPCBs
11	Ancient Monuments and Archaeological Sites and Remains Act1958	Conservation of cultural and historical remains found in India	Yes	Archaeological Department Gol, Indian Heritage Society and Indian National Trust for Art and Culture Heritage (INTACH).
12	Public Liability and Insurance Act 1991	Protection form hazardous materials and accidents.	Yes	SPCBs
13	Explosive Act 1984	Safe transportation, storage and use of explosive material	Yes	Chief Controller of Explosives
14	Minor Mineral and concession Rules	For opening new quarry.	Yes	District Collector
15	Central Motor Vehicle Act 1988	To check vehicular air and noise pollution.	Yes	Motor Vehicle Department

S. No	Act / Rules	Purpose	Applicable Yes/ No	Authority
16	National Forest Policy, 1988	To maintain ecological stability through preservation and restoration of biological diversity.	No	Forest Department, State Government and Ministry of Environment and Forests, Government of India
17	The Mining Act	The mining act has been notified for safe and sound mining activity.	Yes	Department of mining, State Government

b. Applicable Laws and Regulations - Social

All strategic interventions on human development, spread across all social issues, need directives of policies and legal support to operationalize the appropriate actions. These policies and legislations help to overcome the constraints and support administrator, implementer, community and individual in delivery of justice. This section includes the National policies and Acts as detailed under:

National Policies and Acts

- National Tribal Policy, 2006
- National Resettlement and Rehabilitation Policy, 2007
- Land (Acquisition) Act 1894 (as amended)
- Forest Rights Act, 2006

i. National Policies and Acts

The National Tribal Policy (2006)

The zone of influence, provide for compensation of social and opportunity cost in addition to market value of the land and rights over common property (NPV).

- Empowerment of tribal communities to promote self-governance and self-rule as per the provisions and spirit of the Panchayats (Extension to the Scheduled Areas) Act, 1996.
- Protection of political rights to ensure greater and active participation of tribal peoples in political bodies at all levels.

ii. National Resettlement and Rehabilitation Policy for Project Affected Families - 2007

The national policy on resettlement and rehabilitation represents a significant milestone in the development of a systematic approach to addressing resettlement. The policy establishes a Guideline for extending additional assistance to project-affected families, over and above the compensation for affected assets provided under the Land Acquisition (LA) Act.

This policy strikes a balance between the need for land for developmental activities and protecting the interests of land owners and others. The benefits under the new policy are available to all Affected Persons (AP) and families whose land, property or livelihood is adversely affected by land acquisition, involuntary displacement due to natural calamities, etc.

iii. Land Acquisition Act, 1894 (As Modified Until 1st September, 1985)

The Act is applicable to the whole of India except the state of Jammu and Kashmir. The policy provides a broad guideline of procedure of land acquisition. The Land Acquisition (LA) Act of 1984 is commonly used for acquisition of land for any public purpose. It is used at the State level with State amendments made to suit local requirements. Expropriation of and compensation for land, houses and other immovable assets are carried out under the Land Acquisition (Amendment) Act, 1984. The Act deals with compulsory acquisition of private land for public purpose. The LA Act does not contain any provision specifically dealing with resettlement including income restoration aspects.

Table 4.2: The Land Acquisition Process

Legal Provision	Actions
Section 4	<p>Draft prepared by requiring body, verified by the Ministry of Law, printing and proofreading. Publish in official gazette and two local newspapers; post notice locality</p> <p>No further land sales, transfers or subdivisions after notice</p> <p>Appoint Land Acquisition Officer (LAO) to survey land</p>
Declaration of Public purpose	<p>Government certifies that land is required for a public purpose</p> <p>Declaration is published</p> <p>Collector / Deputy Commissioner receives order from Revenue Department, State Government</p> <p>Land appraisal begins (two weeks to a month)</p>
Section 5(a) Enquiry	<p>Enquire objections to LA</p> <p>Land owners and interested parties appear before LAO</p> <p>Revenue commissioner calls for comments of acquiring agency if objections are raised</p> <p>– (one to three months)</p>
Section 6	<p>State government issues notices</p> <p>LAO serves individual notice on all interested parties of government' s intention to take possession of land</p> <p>Time and place set for claims to LAO</p> <p>Public notice given</p> <p>Collector or LAO investigate claims (12 months)</p>
Section 9	<p>LAO conducts on-site inquiry regarding area of LA and compensation payable</p> <p>LAO determines compensation (12 months)</p>

Section 11 and 12	<p>Declaration of final award by Collector/Commissioner/State Government after inquiry of total valuation</p> <p>Notice of awards given to interested parties for payment of compensation</p> <p>Government can take possession of land and hand over to implementing agency (14 months)</p>
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iv. Forest Rights Act 2006

The Act basically does two things:

- Grants legal recognition to the rights of traditional forest dwelling communities, partially correcting the injustice caused by the forest laws.
- Makes a beginning towards giving communities and the public a voice in forest and wildlife conservation

v. Safeguard Policy

The World Bank's current policies – often called “**safeguards**” – were developed over the last 20 years to help identify, avoid, and minimize harms to people and the environment. These safeguards require borrowing governments to address certain environmental and social risks in order to receive Bank financing for development projects.

Examples of such requirements include conducting an environmental and social impact assessment, consulting with affected communities about potential project impacts, and restoring the livelihoods of displaced people. World Bank safeguards are widely seen as an effective way to ensure that environmental and social concerns and community voices are represented in the design and implementation of our projects.

c. Other Legislations applicable to Construction Projects under NGRBP

Construction stage generally involves equity, safety and public health issues. The construction agencies therefore will be required to comply with laws of the land, which include inter alia, the following:

- 5 Workmen's Compensation Act 1923 (the Act provides for compensation in case of injury by accident arising out of and during the course of employment);
- 6 Payment of Gratuity Act, 1972 (gratuity is payable to an employee under the Act on satisfaction of certain conditions on separation if an employee has completed 5 years);
- 7 Employees PF and Miscellaneous Provision Act 1952 (the Act provides for monthly contributions by the employer plus workers);
- 8 Maternity Benefit Act, 1951 (the Act provides for leave and some other benefits to women employees in case of confinement or miscarriage, etc.);
- 9 Contract Labor (Regulation and Abolition) Act, 1970 (the Act provides for certain welfare measures to be provided by the contractor to contract labour);
- 10 Minimum Wages Act, 1948 (the employer is supposed to pay not less than the Minimum Wages fixed by the Government as per provisions of the Act);

- 11 Payment of Wages Act, 1936 (it lays down as to by what date the wages are to be paid, when it will be paid and what deductions can be made from the wages of the workers);
- Equal Remuneration Act, 1979 (the Act provides for payment of equal wages for work of equal nature to Male and Female workers and not for making discrimination against Female employees);
- 12 Payment of Bonus Act, 1965 (the Act provides for payments of annual bonus subject to a minimum of 83.3% of wages and maximum of 20% of wages);
- 13 Industrial Disputes Act, 1947 (the Act lays down the machinery and procedure for resolution of industrial disputes, in what situations a strike or lock-out becomes illegal and what are the requirements for laying off or retrenching the employees or closing down the establishment);
- 14 Industrial Employment (Standing Orders) Act; 1946 (the Act provides for laying down rules governing the conditions of employment);
- 15 Trade Unions Act, 1926 (the Act lays down the procedure for registration of trade unions of workers and employers. The trade unions registered under the Act have been given certain immunities from civil and criminal liabilities);
- 16 Child Labour (Prohibition and Regulation) Act, 1986 (the Act prohibits employment of children below 14 years of age in certain occupations and processes and provides for regulation of employment of children in all other occupations and processes. Employment of child labour is prohibited in Building and Construction Industry);
- 17 Inter-State Migrant Workmen"s (Regulation of Employment and Conditions of Service) Act, 1979 (the inter-state migrant workers, in an establishment to which this Act becomes applicable, are required to be provided certain facilities such as housing, medical aid, travelling expenses from home to the establishment and back, etc.);
- 18 The Building and Other Construction Workers (Regulation of Employment and Conditions of Service) Act, 1996 and the Cess Act of 1996 (all the establishments who carry on any building or other construction work and employs 10 or more workers are covered under this Act; the employer of the establishment is required to provide safety measures at the building or construction work and other welfare measures, such as canteens, first-aid facilities, ambulance, housing accommodation for Workers near the workplace, etc.);
- 19 The Factories Act, 1948 (the Act lays down the procedure for approval of plans before setting up a factory, health and safety provisions, welfare provisions, working hours and rendering information-regarding accidents or dangerous occurrences to designated authorities);
- 20 Hazardous Wastes (Management and Handling) Rules, 1989 (the Rules govern handling, movement and disposal of hazardous waste);
- 21 Manufacture, Storage and Import of Hazardous Chemicals Rules 1989.

5 BASELINE STATUS

5.1 Introduction

The baseline environmental and social status is important to understand the region's existing physical and biological characteristics along with cultural and social status of the residing community. Information and data presented in this section is based on field surveys, stake-holder interaction/consultation and secondary data collection which majorly include the draft Detailed Project Report (DPR) of proposed sewerage work, City Development Plan (CDP) report by Nagar Nigam, Water/ Air/ Noise quality monitoring report of CPCB and Bihar State Pollution Control Board, City census data and others. The information on the baseline environmental conditions forms the basis to analyse the probable impacts of the proposed project vis-à-vis the present background environmental quality of the core study area.

5.2 Project Influence Area

In general 5 km from the project boundary has been considered as Project Influence Area. Within this project influence area the mostly consists of built up area which also includes some old and important buildings. Very few open space is there within the project influence area, the only prominent one is Gandhi maidan. There is no such natural sensitive area observed within the project influence area. However man made sensitive locations like Patna Medical College, Patna College, B.N. College, Patna Law College, temples along the Ghats, some old buildings and few schools are observed. The figure showing general study area has been shown in the figure below.

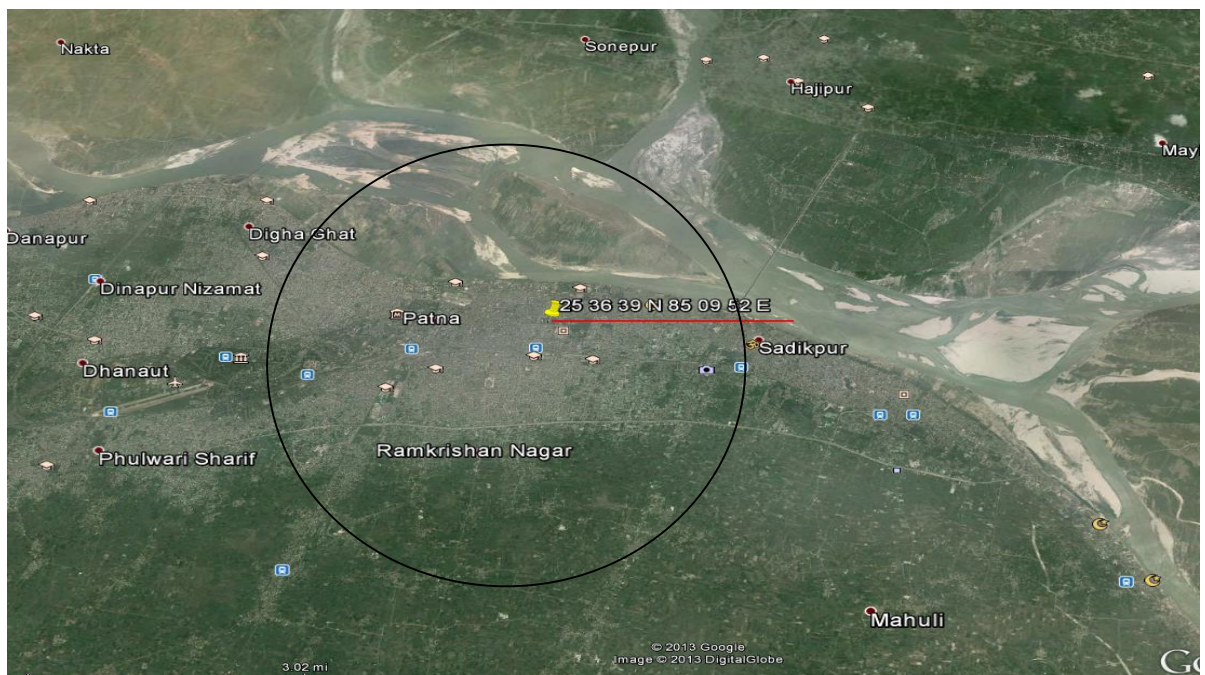


Figure 5-1: General study area of the project.

5.3 Environment and Social screening:

The details of environment and social screening details is shown in table 4.1 as given below:

Screening Checklist Format as per NGRBA ESMF

Environment and Social information format for screening

Project Title: Preparation of Detailed Project Reports (DPRs) & BID Documents; Tendering for Execution; Construction Supervision & Quality Control of Sewerage Project of Patna City: Under NGRBA

Implementing agency: Bihar Urban Infrastructure Development Corporation

Project cost: INR 482 Crores (Package -2: 203 Cr and Package -6: 279 Cr)

Project components: Main Pumping Station (MPS), Outfall Channel and STP (60 MLD & 83 MLD for 2032 & 2047 respectively); Sewer Line, House Sewer Connections, Intermediate Pumping Stations (IPSS), Rising Main; Ward Nos. (27, 28, 35 to 43, 47 to 54); Population for 2047 (6.93 lacs)

Summary of Existing Patna City: Saidpur is bounded by the Ganga river to the North, Delhi-Howrah Railway line to the South, Mahatma Gandhi Setu on East and Mandiri Nalla in the West. The existing sewer line in the city is 7.4 km (main trunk) planned & executed under GAP-I & II and is limited to central part only. This zone has an existing STP with treatment capacity of 45 MLD but due to lack of O&M & funds paucity, the treatment efficiency is reduced to 33 MLD only.

Sr. No.	Screening Criteria	Assessment of category (High/ low)	Explanatory note for categorization
1	Is the project in an eco-sensitive area or adjoining an eco-sensitive area? (Yes/No) If Yes, which is the area? Elaborate impact accordingly.	No	There are no environmental sensitive areas in the proposed project area. Further the small residential parks and road side trees will not be affected (particularly near Ashok Rajpath, Bazar Samiti etc), since the sewers are planned to be laid in the middle of the road and will not pass through these areas.
2			
2.1	Land acquisition resulting in loss of income from agricultural land, plantation or other existing land-use.	No social impact likely to occur due to the acquisition of land	<ul style="list-style-type: none"> STP for Package -2 (83 MLD) has been planned to setup on existing available STP site at Saidpur locations Also there exist no squatters or encroachers in and around the premises who could get affected by the project. The consultant has proposed 04 IPSs for Saidpur Package. Out of total 04 IPSs, it is required to procure land for 01 IPS in Arfabad Area (Zone -IVA_N). The process for procurement has been taken up by BUIDCo and is likely to be procured within the time frame.
2.2	Loss of livelihood	No	Loss of livelihood is not expected and since mobile vendors can change their location, there would be no loss. There could be minor disruption in terms of access to shops.
2.3	Land acquisition resulting in relocation of households.	No social impacts	No Major Land acquisition required and no relocation of households required since identified plots of land do not have any habitations or

Sr. No.	Screening Criteria	Assessment of category (High/ low)	Explanatory note for categorization
			settlements. A pocket of land is required to be procured for IPS but that too is planned on vacant land. Thus, no relocation of household require for this package. The locations of STP as proposed on existing site thus no habitation/ household relocation is required. Also there exist no squatters or encroachers in and around the premises which will be affected.
2.4	Any reduction of access to traditional and river dependent communities (to river and areas where they earn for their primary or substantial livelihood).	No social impacts	No access problem likely to be there to river
2.5	Any displacement or adverse impact on tribal settlement(s).	No social impacts	There are no tribal settlements in the project area.
2.6	Any specific gender issues	No social impacts	No gender issues were reported during survey
3			
3.1	Clearance of vegetation/ tree-cover	No environmental impacts	The tree/ vegetation cover in areas (Ehibition road, Kankar Bagh road, Ashok Rajpath, Rajendra Path, Gandhi Maidan etc) are aligned along the road sides and will not be affected as the sewer lines will be laid in the centre of the roads. There will also be no impact on the residential parks such Zoological park in Zone –III & IVA.
3.2	Direct discharge of construction runoff, improper storage and disposal of excavation spoils, wastes and other construction materials adversely affecting water quality and flow regimes.	Limited & Temporary	Possibility of temporary flushing away of un-managed spoils and construction wastes during rainfall to river Ganga/ Punpun via storm water drains. If not appropriately managed, there may be potential for temporary effect on storm water flows by obstruction to flows and blockage of drains, especially during rainfall. This may cause floods.
3.3	Flooding of adjacent areas	Limited & Temporary	For sewerage works in the entire city, flooding could be an issue during the monsoons, especially in the congested regions like in and around Shahgunj, Kadam Kuan, Rajendra Nagar etc areas. This issue may

Sr. No.	Screening Criteria	Assessment of category (High/ low)	Explanatory note for categorization
			further aggravate due to blocked drains and poor solid waste management in the city.
3.4	Improper storage and handling of substances leading to contamination of soil and water	Limited & Temporary	<p>The storage of construction related material will not cause any contamination since these materials would typically include: Concrete, pipes, masonry, rubber pipes.</p> <p>The project area have some small talabs & some historical ghats (Anta ghat & Krishna Ghat) near to Gandhi Maidan. However these areas will not be affected as sewer lines are not planned to be laid through any of these areas.</p> <p>However, with other finer materials such as construction powders, fluids and greases, if not appropriately managed or in the event of an accident, there may be potential for temporary contamination of the river Ganga via the various drains and nallas, during rainfall.</p> <p>If construction material will not be handled appropriately, it may affect agricultural lands minutely.</p>
3.5	Elevated noise and dust emission	Limited & Temporary	<p>For sewage works, construction is likely to increase dust and noise levels temporarily.</p> <p>Temporary impacts may especially be felt at educational facilities like schools/colleges (NIT Patna, St. Xavier's High School, BD Public School, Indira Gandhi Planetarium, Patna Museum & High Court, hospitals (Patna Medical College & Hospital (PMCH) etc), cultural/religious centers including all temples, mosques, churches and Gurudwaras in the region.</p>
3.6	Disruption to traffic movements	Limited & Temporary	Traffic disruption can be expected in busy areas such as area around Ashok Rajpath, Bazar Samiti, Rajendra Nagar etc area due to transportation of material of construction.
3.7	Damage to existing infrastructure, public utilities, amenities etc.	Limited & Temporary	If not appropriately managed, there may be potential for temporarily affecting the existing public utilities

Sr. No.	Screening Criteria	Assessment of category (High/ low)	Explanatory note for categorization
			like water supply, telephone, electricity cables etc. However, in the proposed scheme, there is a proper relocation of all utilities like telecom, water line, electricity, etc is provisioned.
3.8	Failure to restore temporary construction sites	Limited & Temporary	From field visits and as per JNNURM project (Water Supply scheme) reinstatement of dismantled roads after filling and proper compaction was observed. Although temporary, concerns regarding failure to restore construction sites including failure to close and appropriately fence-off open pits were cited as safety concerns especially for children.
3.9	Possible conflicts with and/or disruption to local community	Limited & Temporary	For the laying of sewer works, there will be temporary disruption to the local community in terms of access to roads, (especially in dense areas and narrow roads), shops and residences. Conflicts/ disruption to local community was inferred as limited based on survey responses which indicated the community's ability to adapt to temporary disruptions, and their overall preference for the project.
3.10	Health risks due to unhygienic conditions at workers' camps	Limited & Temporary	Field visits and as per Water Supply project no worker camps were seen.
3.11	Safety hazards during construction	Limited & Temporary	From field visits and as per Water Supply project practices for safety precautions such as fencing-off construction areas, sign posts etc. were observed. If not appropriately managed, there may be potential for temporary hazards such as injuries and damage to property during the construction phase.
4			
4.1	Flooding of adjacent areas	Limited & Temporary	Due to the construction of sewer lines, raw sewage that currently flows into the river and/ or overflows into the streets. However, accidental leakages during the operational stage may lead to flooding and possible contamination of groundwater. Additionally,

Sr. No.	Screening Criteria	Assessment of category (High/ low)	Explanatory note for categorization
			overloading and blockage of sewage lines will also lead to backlogging of sewers and flooding of branch sewers.
4.2	Impacts to water quality due to effluent discharge	No social impacts	There will be a significant improvement in water quality due to effluent discharge being treated.
4.3	Gas emissions	No social impacts	There will be <i>reduction</i> in gas emissions from open sewage drains since the proposed sewage networks will be underground.
4.4	Safety hazards	No social impacts	There will be minimum safety hazards since the sewer lines will be underground.
5	Do projects of this nature / type require prior environmental clearance either from the MOEF or from a relevant state Government department? (MOEF/ relevant State Government department/ No clearance at all)	No clearance required	Project such as these have an overall positive impact for the environment and society. Hence no clearance would be required under the Environmental Impact Assessment Notification, 2006.
6	Does the project involve any prior clearance from the MOEF or State Forest department for either the conversion of forest land or for tree-cutting? (Yes/No). If yes which?	No clearance required	As the project is in urban provinces and does not require any forest land of tree-cutting, hence no prior clearance is required from relevant authorities (MoEF and State Forest departments) under the Forest (Conservation) Act, 1980. There may be requirement of trimming of some trees for providing accessible pathway to the excavators and other construction vehicles but same need no consent/ approval of any of these dept.
7	Please attach photographs and location maps along with this completed Environmental Information Format For Screening.	Attached along with the report	
8	Overall Assessment	High	The project involve 228 km of sewer lines, 5 pumping stations and an STP

Based on the screening activity and the categorization of potential sub-projects of the NGRBA, the present project of Sewerage work in Sewerage Phase -I in Patna City falls under high impact category. In view of the above, these projects would require preparation of an Environmental and Social

Assessment, as part of the DPR, and implementation of Generic Safeguard Management Plan (SMP), relevant to the project.

5.4 Baseline Condition of Project Surrounding Area

5.4.1 Topography

Patna is located on the south bank of the Ganga River. The town is situated at an altitude of 48 - 51 m above mean sea level. A characteristic of the geography of Patna is its confluence of rivers. The Ganga River is the largest. It is joined by four other rivers: Ghaghara, Gandak, Punpun and Sone. Patna is unique in having four large rivers in its vicinity. Patna does not contain any hilly region. It has an entirely alluvial and flat region. The Saidpur sewerage zone falls under the alluvial plain.

5.4.2 Climate

The district by and large is homogenous. It is of moderate type characterized by quite hot summers to moderately cold winters. The day temperature generally ranges from 21.1 °C in January to 38.7 °C in May and night temperature from 7.3 °C in December to 27.7 °C in June. The summer begins in April and peaks in June/July with the temperature soaring up to 43 °C till the moisture laden monsoon wind brings some much-needed relief to the parched fields. The rains last through August & September and continue into early October.

Table 5.1: Climatological Normal of Temperature, Humidity and Rainfall at Patna

Month	Temperature (°C)		Monthly	Humidity (%)	
	Maximum	Minimum		0830 Hrs	1730 Hrs
January	23.3	9.2	18.9	76	57
February	26.5	11.6	10.7	66	45
March	32.6	16.4	11.4	50	30
April	37.7	22.3	7.6	44	23
May	38.9	25.2	33.3	56	32
June	36.7	26.7	134.2	70	54
July	33.0	26.2	305.8	83	74
August	32.4	26.1	274.4	84	77
September	32.3	25.4	226.9	82	76
October	31.5	21.8	93.8	75	68
November	28.8	14.7	8.9	70	60
December	24.7	9.9	4.1	75	60

Source: India Metrological Department data from 1951-1980)

5.4.3 Geomorphology & Soils

Patna district is a part of the Indo-Gangetic alluvium, which separates Extra-Peninsular regions on the north from the Peninsular region on the south. The level plain is known to be the outcome of a granular filling of a great depression with alluvial sediments since Middle Pleistocene times. The district forming a part of the flood plains of the Ganga has a monotonously flat relief. The area is underlain by unconsolidated formation which is quaternary to Upper quaternary of age group. Lithologically, the district is made up of recent alluvium, clay, silt, sand, gravel pebbles with concentration of calcareous materials. The presence of kankar (nodules of CaCO₃) and fine sand at places render the top clay zone semi-pervious in nature. The area under study is underlain by alluvial sediments of quaternary age. The quaternary sediments are deposited unconformable on the Archaean basement.

The district has mainly four types of soils ranging from moderately well drained to poorly drained, acidic to slightly alkaline and medium to heavy textured. From the farming point of view only four types of soils may be recognised as light to heavy in texture.

Soils in Saidpur sewerage zone usually comprise a layer of clay on the top surface. Thick sandy horizon occurs beneath the top clay layer having sufficiently large thickness. The soil in this area, represents older alluvium. In general the Calcareous Alluvium has higher potential of binding of molecules than the newer alluvium or acidic alluvium and hence the chance of erosion in Calcareous alluvium is

comparatively lesser than acidic alluvium. Chemical analysis study of the soil has been presented in the Table 5.2 below:

Table 5.2: Quality of Soil Sample

	Parameter	Unit	Results
1	pH	-	8.85(1:5) 26°C
2	Texture	-	Silt loam
3	Sand	%	26 - 32
4	Silt	%	45-50
5	Clay	%	21-25
6	Bulk density	g/cc	1.2- 1.29
7	WHC	%	46- 50
8	OM	%	1.1 1.2
9	N	mg/kg	281 -360
10	P	mg/kg	12- 16
11	K	mg/kg	135 - 185
Source: Laboratory Analysis			

5.4.4 Seismicity

The project area falls in seismic zone – IV as per the BIS (1893, Part-1, 2002) category of seismic zoning map of India.

5.4.5 Ground Water Scenario

Besides State Ground Water Investigation Department, Govt. of Bihar, CGWB has established a network of observation wells under National Hydrograph Network (HNS) programme to ascertain fluctuation and quality of groundwater in the district. There are about 12 HNS monitoring locations identified and being monitored every year regularly during January, May, August and November.

During pre-monsoon season, the minimum and maximum water levels were observed as 3.00 and 8.57 m bgl respectively. About 25 % of the wells have the water level in the range of 2 – 5 m bgl. The interceptions of water table will be controlled by well sinking method and other method also for dewatering. In majority of the wells (76 %), the water levels remain in the range of 5 – 10 m bgl. **Figure 5-2: & Figure 5-3:** below depict water level map of Patna district post monsoon and pre monsoon in year 2006.

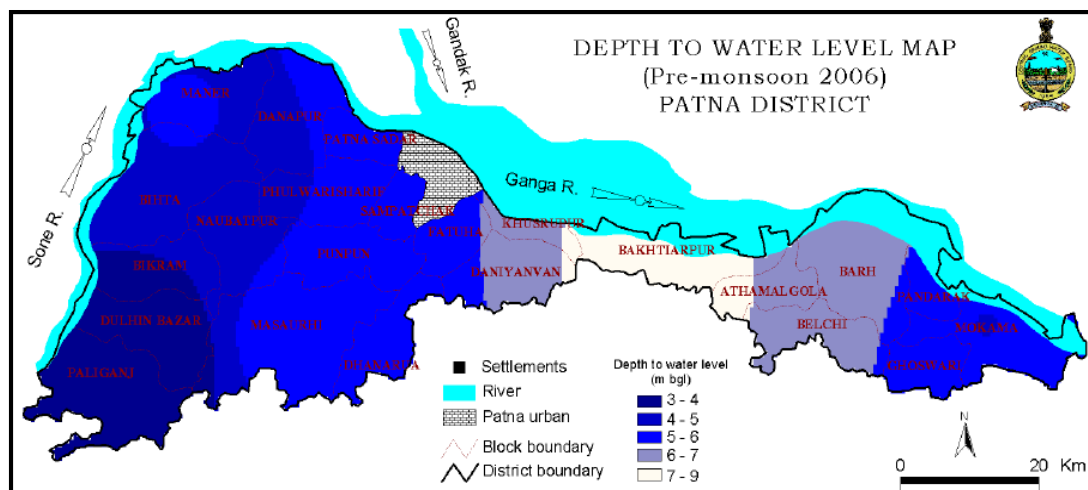


Figure 5-2: Water Level Map (Pre Monsoon 2006)-Patna District

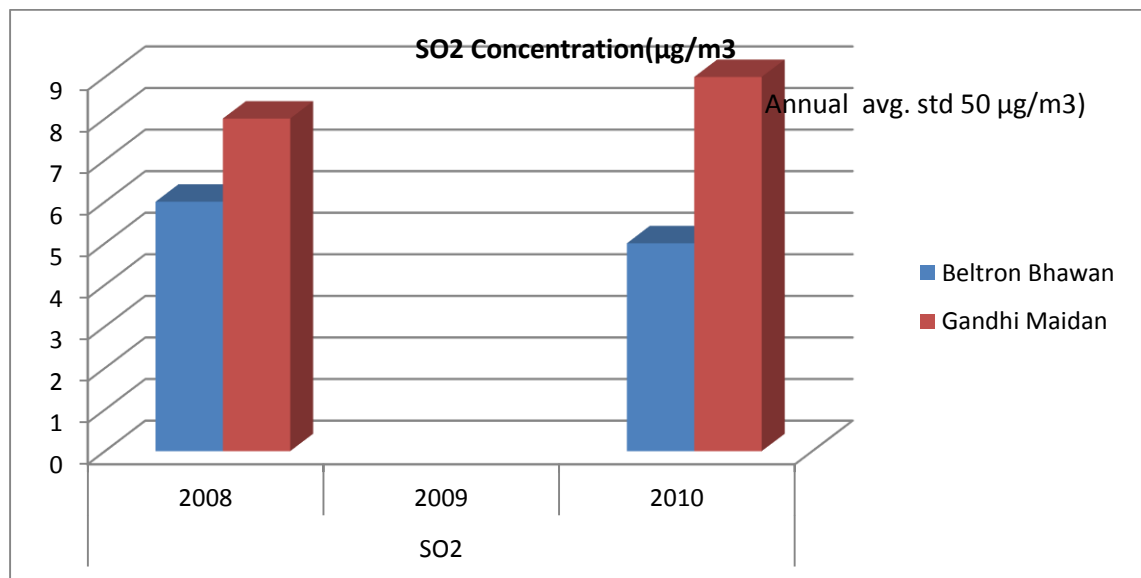


Figure 5-5: Trends in annual avg. concentration of SO2 in residential areas

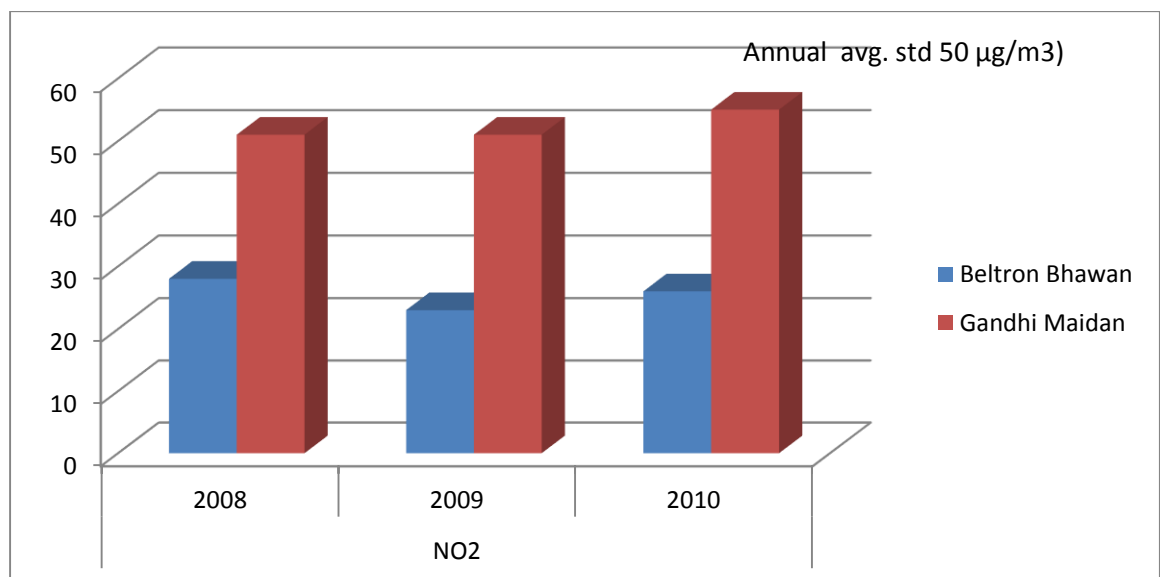


Figure 5-6: Trends in annual avg. concentration of NO2 in residential areas

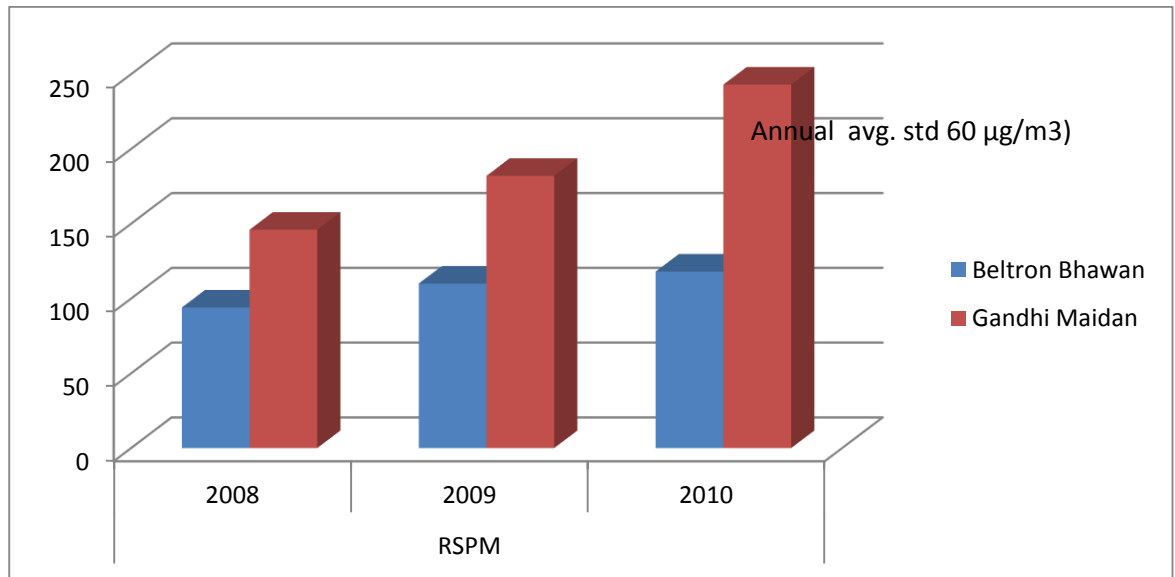


Figure 5-7: Trends in annual avg. concentration of RSPM in residential areas

5.4.7 Surface Water

The river Ganga is within 1.0 km distance of the project site. The Central pollution control board regularly monitor river water quality at Patna Stretch.

To study the water quality of River Ganga, the Central Pollution Control Board (CPCB) has set up water quality monitoring stations on the main river and on its various tributaries. It is observed that BOD and DO comply with the standard at all the locations, while FC does not conform to the standard at any of the locations. BOD shows an increasing or a marginally increasing trend at all the locations. No trend is observed with respect to DO. The Ganga river water quality trend at Patna stretch has been depicted in the **Error! Reference source not found.**figure- 5.4-5.9 below:

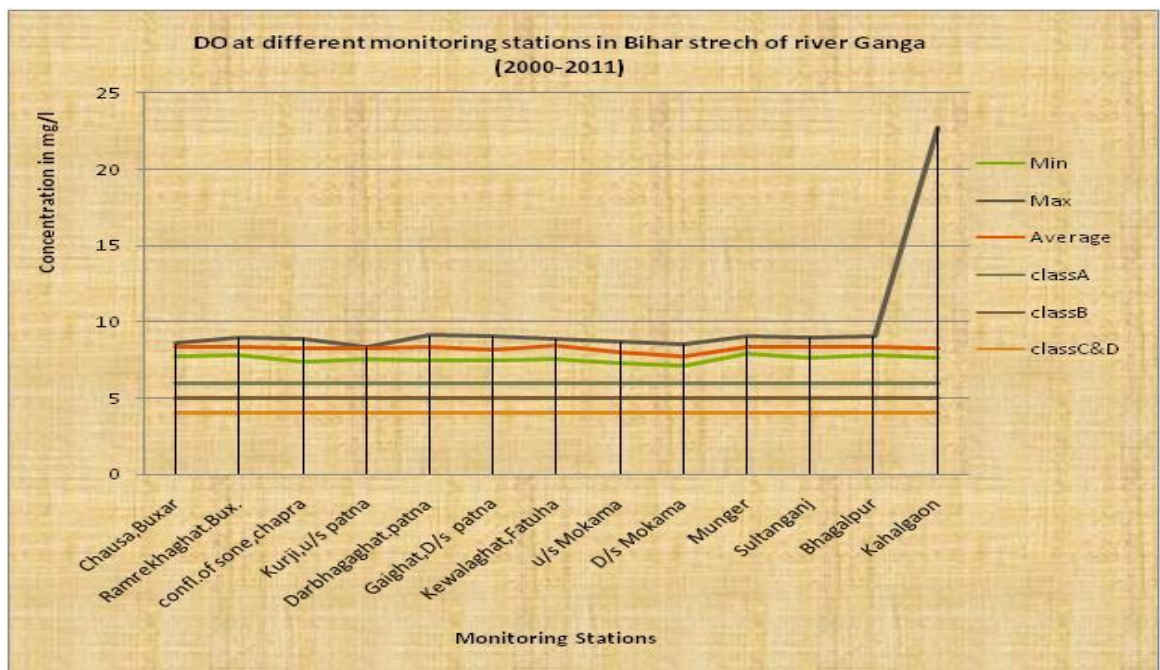


Figure 5-8: Ganga river water quality trend at Patna Stretch in terms Dissolved Oxygen

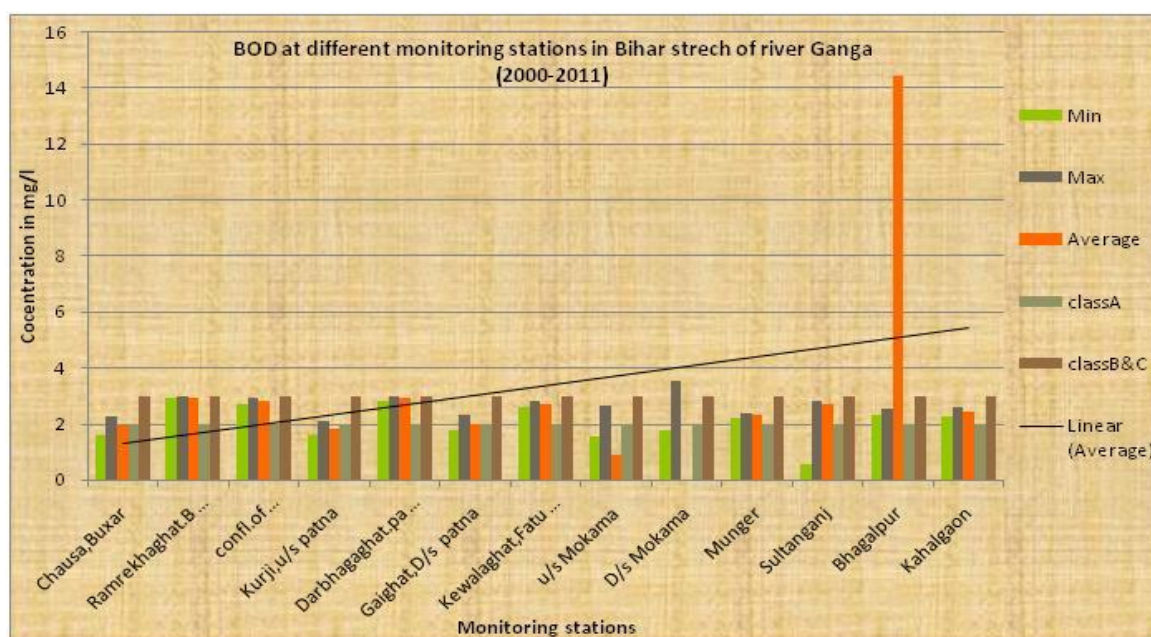


Figure 5-9: Ganga river water quality trend at Patna Stretch in terms BOD

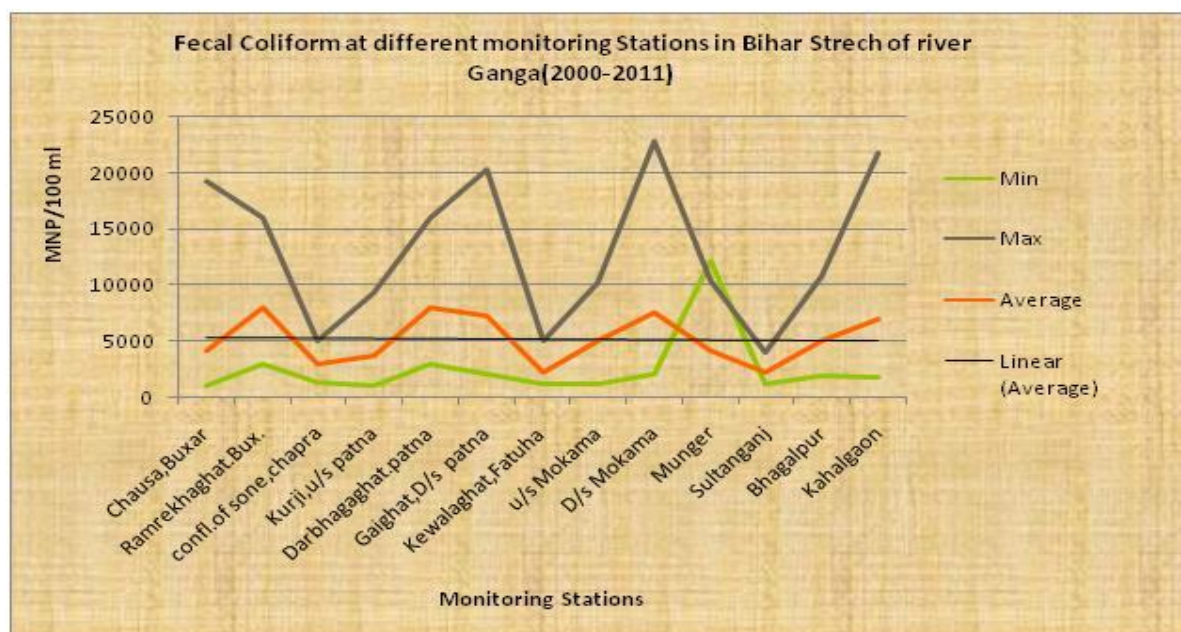


Figure 5-10: Ganga river water quality trend at Patna Stretch in terms Feacal Coliform

As per the latest water quality monitoring conducted by Bihar State Pollution Control Board (Table 5.2), the biochemical oxygen demand (BOD) levels at all stations are often above the permissible 3.0 mg/l for outdoor bathing waters and also above 2.0 mg/l limit for the drinking water standard, as set by the Indian Standard code. However, the water quality parameter of dissolved oxygen (DO) seems within permissible limits. The minimum DO levels for water as per the Indian standard code ranges from 4.0-6.0 mg/l for drinking and bathing respectively. The river Punpun water quality has been depicted in Table 5.3

Total coliform and fecal coliform were present at all stations, indicating possible contamination from municipal waste water discharges from the city. The presence of fecal coliform in the water also indicates a greater potential of the presence of pathogenic microorganisms, which may cause waterborne diseases, leading to detrimental impacts on the health of the community. During summer, the river flow reduces and at increased temperature the bacterial activities increases to oxidize the organic matter discharged into it from various domestic and industrial sources.

Table 5.2: Ganga River Water Quality at Patna as conducted by Bihar State Pollution Control Board

Parameter	Digha near Railway Bridge (U/S)	Gaighat (D/S)	General standard for discharge on inland surface water as per CPCB
BOD(mg/l)	2.6	2.8	30
COD (mg/l)	16	20	250
TSS (mg/l)	28	30	100
DO	8.0	7.8	
T. Coli (MPN/100 ml)	3000	9000	500
F. Coli(MPN/100 ml)	1300	3000	

Table 5.3: Punpun River Water Quality as conducted by Bihar State Pollution Control Board

Parameter	Railway Bridge (U/S)	Fatua (D/S)	General standard for discharge on inland surface water as per CPCB
BOD(mg/l)	2.0	2.5	30
COD (mg/l)	16	20	250
TSS (mg/l)	26	34	100
DO	7.5	7.0	
T. Coli (MPN/100 ml)	1400	1700	500
F. Coli(MPN/100 ml)	500	700	

5.4.8 Noise quality

The baseline environmental monitoring for noise quality was conducted through primary survey to at strategic locations considering various project components like construction of STP, SPS, laying of sewer line etc. The baseline noise levels helps in understanding the existing noise level so that necessary monitoring mechanism and safeguard measures can be formulated for the possible impacts from the project on noise quality during the construction and operation stages of the project. The existing baseline noise level is presented in table 5.4.

Table -5.4: Noise Quality at Saidpur, Patna

Locations Name	Equivalent Noise Level Leq (dB(A)) 6.0 am to 10.0 pm	Permissible Limit Leq (dB(A))	Category of Area/ Zone
Saidpur STP	52.3	55	Residential Area
SPS (Peer muhani)	67.2	65	Commercial Area
Nala Road	70.4	65	Commercial Area
Lohanipur Near Shiv Mandir	71.1	65	Commercial Area

Source: Envic Bihar state pollution control Board

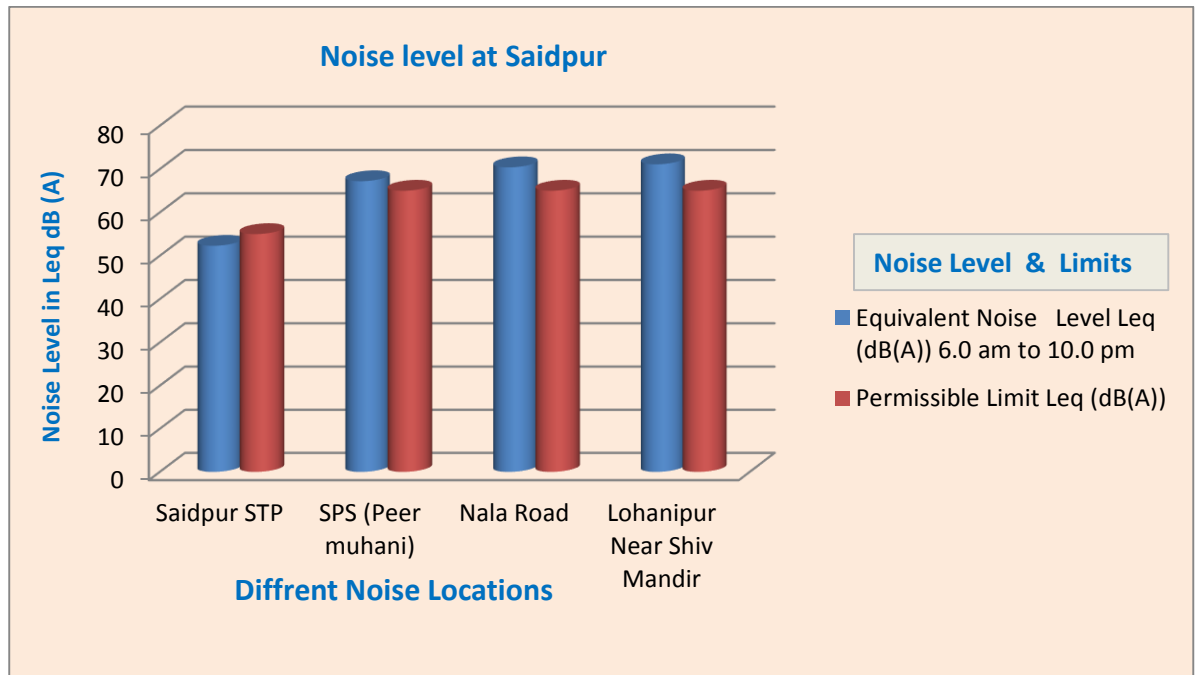


Figure 5-11: Noise quality trend at Patna Stretch

The available data of noise level indicate that the average noise levels of all above given locations are exceeding the permissible limits except Saidpur STP this is just because of heavy traffic throughout the day.

The average day Ambient Noise levels data was taken source from Envis (MoEF) / BSPCB, Patna site for residential, commercial, industrial and sensitive locations during the month of May 2014.

5.4.9 Ecology and Biodiversity

Forest Resources: Bihar is situated in the eastern part of India bordering Nepal and has a geographical area of 94,163 km². It is part of gangetic plains and is drained by two major rivers, the Ganga and the Gandhak. Annual rainfall in the state varies from 1000mm to 2000 mm.

The recorded forest area of the state is 6473 km² which is 6.87% of the geographical area. Reserve forest constitutes 10.70%, Protected Forest 89.28% and unclassified Forest, which is about 0.02% of the total forest area. Patna district has deciduous type of forest. The district has 3202 km² of Geographical area comprising 13 km² of Moderately Dense forest, 3 km² open forest and absence of Very Dense forest. Thus the forest cover of the district is 0.50% of total Geographic Area. (Source: State Forest Report – 2009).

Flora: The phytosociological study of the core zone (terrestrial habitat) beyond the riparian habitat comprises of manmade ecosystem. Trees plantation in form of landscaping was noticed due to nearby residential area, government offices, hospitals, university, parks and market places. The species of trees reported are mainly planted, except few species which are naturally growing. These trees are fruit, flower and seed bearing and attract avifauna, small mammals and reptiles. Nesting was commonly reported. Species of trees reported during primary survey are given in Table below.

Table 5.5: List of trees reported in the project affected area

S.No	Common Name	Scientific Name
1	Peepal	Ficus religiosa
2	Bargad	Ficus benghalensis
3	Sissoo	Dalbergia sissoo
4	Jamun	Syzygium cumini

S.No	Common Name	Scientific Name
5	Neem	Azadirachta indica
6	Sal	Shorea robusta
7	Salai	Boswellia serrate
8	Bahera	Terminalia arjuna
9	Mango	Mangifera indica
10	Golden shower	Crassia fistula
11	Bakain	Melia azadirachta
12	Jackfruit	Artocarpus heterophyllus
13	Kadamb	Anthocephalus cadamba
14	Bail	Aegle marmelos
15	Siris	Albizia procera
16	Devil Tree	Alstonia scholaris
17	Royal Palm	Roystonea regia
18	Amla	Phyllanthus emblica
19	Neem	Azadirachta indica
20	Coconut	Coco nucifera
21	Umar	Ficus racemosa
22	Mango	Mangifera Sp
23	Gular	Ficus Glomerata
24	Palash	Butea monosperma
25	Gulmohar	Delonix regia
26	Kala siris	Albizia lebbeck
27	Semal	Bombax ceiba
28	Bair	Zizyphus jujube

Fauna: To study the diversity of fauna, various survey methods were adopted. The survey was mainly carried out at dawn and at dusk to study animal behavior and habitat. This study period is mainly selected as animals are most active.

Secondary data was collected from the forest department and interaction with the local was also conducted to establish baseline study for distribution of wild animals in the study area. No wild mammals are reported in the study area, due to anthropogenic activity and urbanized habitat. Domestic mammals are reported in the study area.

Avifauna:

The fauna reported in the inner buffer zone are mainly avifauna (highest diversity) followed by mammals and reptiles. The commonly reported avifauna in the study area during primary survey, with higher diversity are Common crow, Myna, Eagle, Sparrow, Babbler, Pigeon, Cattle Egrets, Red Vented bulbul, Drongo, Sparrow, Indian Roller etc. During site visit higher frequency of birds recorded in the project affected. This is mainly due to availability of nesting habitat, discarded foods from rituals

ceremony and fruits bearing trees. Table 4.3 gives the list of avifauna reported in the core zone and inner buffer zone.

Table 5.6: List of Avifauna reported in inner buffer zone

S.No	Common Name	Scientific Name
1.	Red Wattled Lapwing	<i>Vanellus indicus</i>
2.	Rock Pigeon	<i>Columba livia</i>
3.	Cattle Egrets	<i>Bubulcus ibis</i>
4.	Cuckoo	<i>Cuculus micropterus</i>
5.	Red Vented Bulbul	<i>Pycnonotus cafer</i>
6.	Common Crow	<i>Corvus splendene</i>
7.	Common Myna	<i>Acridotheres tristis</i>
8.	Common Babbler	<i>Turdoides caudate</i>
9.	Green Bee eater	<i>Merops orientalis</i>
10.	House sparrow	<i>Passer domesticus</i>
11.	Drongo	<i>Dicrurus bracteatus</i>
12.	Egret	<i>Casmerodius albus</i>
13.	Cattle Egret	<i>Bubulcus ibis</i>
14.	Rose ringed parakeet	<i>Psittacula krameri</i>
15.	Spotted dove	<i>Spilopelia chinensis</i>
16.	Bank Myna`	<i>Acridotheres ginginianus</i>

Mammals:

During primary survey no wild mammals are reported in the study area. Based on secondary information like interaction with the local, wild mammals like Indian mongoose and five striped squirrel are reported. Domesticated mammals like goat, sheep, dog, cow, ox, donkey etc. are reported. These animals are domesticated for milk and other commercial purposes.

Reptiles:

Based on forest working Plan and interaction with people dwelling nearby ghat areas, it has been confirmed that the study area witness poor reptilian distributions. Reptiles like Rat Snakes (*Ptyas mucosus*), Common Kraits (*Bungarus caeruleus*), Indian cobra (*Naja Naja*) etc. has been reported. House Gecko and Garden Lizard are directly sighted during primary visit.

Wildlife Protected area and Wildlife Sanctuary

One Wildlife National Park (Valmiki National Park) and twelve Wildlife Sanctuaries are located in Bihar. However, no National Park and Wildlife Sanctuary is reported within 10 km from project boundary. During primary survey Schedule – I mammals as per WPA – 1972, like fresh water Dolphin (*Platanista gangetica gangetica*) was seen in river Ganga stretch in Patna city.

Wetland: No wetland notified under “The Ramsar Convention – 1971” or listed under “the National wetland Conservation Programme – 2009” is reported within 10 km from project boundary.

5.4.10 Baseline Social Status

Patna has 23 blocks. The total area is 3,202 sq km and population of the district is 4,718,592. The literacy rate is 62.92%. The female literacy rate is 50.83%. The male literacy rate is 73.34%. The number of households in Patna is 726,364. Out of which rural household is 419,619 and the urban household is 306,745.

Female to male ratio of Patna is 87.25%. Female to male ratio of the district is less than state's female to male ratio 91.93%. Urban female to male ratio of the district is 84.44% compared to rural female to male ratio of 89.31%.

The literacy rate of the district is 62.92% compared to the literacy rate of state 47%. The female literacy rate is 50.83% compared to male literacy rate of 73.34%. The rural literacy rate is 51.4% compared to urban literacy rate of 78.08%. The rural female literacy rate is 36.57% compared to urban female literacy rate of 70.17%. The rural male literacy rate is 64.49% compared to urban male literacy rate of 84.69%.

The total working population is 36.56% of the total population. 54.08% of the men are working population. 16.23% of the women are working population. The main working population is 29.8% of the total population. 47.59% of the men and 9.16% of the women are main working population. The total non working population is 63.44%. 45.92% of the men and 83.77% of the women are non working population. Drinking water facilities, safe drinking water, and power supply are quite common; electricity access is more common for domestic uses than agricultural ones. Fitting with the educational background of the area, primary schools are common while institutes of higher education are very few. Medical facilities also appear to be in relatively short supply. Paved and mud roads are nearly equal in prominence, and both appear fairly common.

The impact of this development project were identified through a series of exercises including social screening during early project preparation stage and detailed social impact assessment and public consultation in the project area.

The Saidpur sewerage zone has 24 wards. Most of the land use in District C has been identified as residential, through the field survey. The existing population and the projected population for the design period year are described in the table below:

Table 5.7 Ward wise census population and projected population and observed land use.

Ward no.	Area, ha	Important Locations	Population	Projected Population		
			2001	2017	2032	2047
27	123.86	Muradpur	19000	25768	37983	50063
28	115.73	Adalat Ganj, Budha Memorial Park, Patna Jankshan	19000	17922	29235	46991
35	24.56	Buddha Murti, Post office, Pir mohani	18000	6505	11195	16329
36	34.41	Pir Mohani	18600	20521	25222	31596
37	90.39	Gandhi Maidan	19076	23996	33953	44437

Ward no.	Area, ha	Important Locations	Population	Projected Population		
			2001	2017	2032	2047
38	49.05	Kadam Kuan	19074	21744	27982	35771
39	14.32	Baker Ganj	19453	19946	20787	21741
40	33.19	Patna Medical College Hospital, IPW Quarters	19467	21237	25640	31799
41	92.32	Nayatola	19968	24768	34688	45320
42	64.15	Kazipur	18000	21701	29676	38593
43	95.74	Rajendra Nagar	19447	24559	34843	45622
47	146.67	Rampur, Muhammadpur	18850	26929	40361	53467
48	81.62	Shahgunj	19457	23812	32994	43022
49	88.57	Sultan Ganj	19463	24188	33925	44333
50	56.09	Dargah, Mahendru, PTO, Shahganj	19471	21400	24339	27125
51	34.86	Sultan Ganj, Mahendru	18000	19297	21356	23422
52	52.07	Alam Ganj, Ganga Bridge Colony	18000	19937	22851	25568
53	42.38	Sondatpur, Balkishan Ganj, Alibuxpur	18339	11634	13808	15694
54	136.84	Sondatpur, Ambedkar Nagar	18339	26086	39056	51715
Total				401950	539894	692608
Say				4.02 lacs	5.40 lacs	6.93 lacs

6.0 ANALYSIS OF ALTERNATIVES

Analysis of alternatives involves a thorough study of the possible future conditions in the project study area of the possible future conditions in the project area in response to a set of alternatives without the project or status quo condition.

6.1 Analysis of Alternative Site

The project is renovation cum augmentation of existing sewage treatment plant. Limited environmental impacts are expected during construction. Little air, water and noise pollution is expected from the proposed construction activities; however these are localized impacts and can be minimized with

proper construction schedule and precautionary approach. Since the project is in an existing piece of land no alternate sites were considered. Moreover, he proposed plant site is in accordance with MoEF guidelines:

22 There are no National Parks/Sanctuaries within 10 km radius.

23 There are no Historical places/places of tourist importance within 10 km radius.

Sewage Pumping Stations: Total intermediate pumping stations proposed in the Sewerage network are 03 for Zone –III & 01 for Zone –IV (N). Out of 04 numbers of proposed pumping stations are both the are on govt. land in Saidpur zone, only 01 pumping stations at Arfabad location is proposed to cater to the load of zone IV A(N). The locations of pumping stations proposed to be retained are Exhibition Road PS, Pirmuhani & Kadam Kuan for Zone –III. The proposed sewerage network encounters few valley points within the city area, where gravity flow of sewerage would be leading to very deep sewers in the range of 7 - 10 m depth. To avoid such deep sewers, in detailed design of sewers, proposals for pumping station are formulated in the design. These intermediate pumping stations are so placed that the depth of sewers through the zone restricted to 6.0 m generally. No alternative pumping site has been considered, as the proposed expansion project facilities will be installed within the existing infrastructure facility. The majority of pipeline will be laid in the same passages.

6.2 Analysis of Alternative Technology

Table 5.4: Comparative statement of different STP technology is highlighted below:

Technology	Merits	Demerits
Conventional Activated Sludge Process (ASP)	<ul style="list-style-type: none"> ➤ Land requirement is less compared to others ➤ Reduced flies and odour nuisance ➤ Better control possible 	<ul style="list-style-type: none"> ➤ High Capital cost ➤ High Power requirements ➤ Skilled labour is required for O & M.
Extended Aeration (EA)	<ul style="list-style-type: none"> ➤ High quality effluent ➤ Lesser complicated design and operation ➤ Capable of treating shock loads ➤ Well stabilized sludge 	<ul style="list-style-type: none"> ➤ Higher power requirements for aeration ➤ Relatively larger tanks ➤ Mainly used for smaller plants
Sequencing Batch Reactor (SBR)	<ul style="list-style-type: none"> ➤ Simplified process ➤ Final clarifiers and Return Sludge pumping not required. ➤ Compact ➤ Operation is flexible; nutrient removal possible ➤ Better SS settling and high effluent quality ➤ Batch system eliminates peak surges ➤ Automatic control of MLSS and SRT through sludge wasting. 	<ul style="list-style-type: none"> ➤ High Peak flows can disrupt operation ➤ Skilled labour required ➤ Batch discharge may require equalization prior to disinfection ➤ Frequent sludge disposal ➤ Higher specific energy consumption
Cyclic Activated Sludge (CAS)	<ul style="list-style-type: none"> ➤ External clarifiers, sludge scrappers, recycle pumps not required. ➤ Well settleable sludge flocks. ➤ Control in time enables flexibility by adapting times for nitrification, Denitrification, 	<ul style="list-style-type: none"> ➤ Extensive piping and valves/gates required. ➤ Higher maintenance skill required

	<ul style="list-style-type: none"> ➤ Biological phosphorous removal, sedimentation, depending on influent characteristics. ➤ Easy & compact construction. ➤ No moving mechanical parts ➤ Less head loss 	
Membrane Bio Reactor (MBR)	<ul style="list-style-type: none"> ➤ High quality nitrified effluent ➤ Compact ➤ Plant expansion is simple ➤ Capable of absorbing hydraulic and organic shock loads. ➤ No secondary clarifier required. 	<ul style="list-style-type: none"> ➤ High capital & O&M cost ➤ Extensive piping and valves ➤ Higher maintenance skill required
Trickling filter	<ul style="list-style-type: none"> ➤ Capacity to handle shock loads ➤ Dependable performance ➤ Minimum supervision. ➤ Lesser land requirement in comparison with other conventional systems. 	<ul style="list-style-type: none"> ➤ Capital costs and power requirements are high. ➤ Mosquito and odour nuisance is high. ➤ Equipment is prone to heavy corrosion.
Fluidized Aerobic Bioreactor (FAB) and Moving Bed Bioreactors (MBBR)	<ul style="list-style-type: none"> ➤ Long SRTs. ➤ High quality effluent (low SS and COD) ➤ Compact-lesser land requirement. ➤ Low temperature sustaining capability ➤ No sludge recycling ➤ Fully digested sludge ➤ High coliform removal. 	<ul style="list-style-type: none"> ➤ Separate secondary settling tank required with sludge removal facility ➤ Sensitive process ➤ High power requirement ➤ Skilled Manpower required for O & M.
Submerged Aerobic Fixed Film (SAFF)	<ul style="list-style-type: none"> ➤ Not restricted by conventional limits of (MLSS). ➤ Clear treated water with consistent outlet BOD. ➤ Lesser area than conventional systems ➤ Lesser bacterial sloughing and does not require extensive sludge management systems ➤ Lesser power ➤ Low operation and maintenance costs. ➤ Installation can be below ground. 	<ul style="list-style-type: none"> ➤ Clogging of reactor due to absence of primary sedimentation. ➤ Reliance on proprietary filter media. ➤ Strict quality control on media. ➤ High reliance on external energy input. ➤ Requires skilled manpower. ➤ Yet to be validated on reasonable number and sizes of STPs in India

Sewage treatment plant based on sequential batch reactor (SBR) is a proven technology and has some specific advantages compared to other conventional technology. Specific advantages of SBR process have been highlighted below:

- 24 Land requirement of SBR based plant is very less and suits site condition
- 25 Effluent characteristics are par best and meet every stipulated guidelines

- 26 Have a proven track record throughout the nation.
- 27 Treated effluent can be utilized for any purpose of reuse
- 28 Module based plant, ease in O&M & future augmentation

Therefore, Sewage treatment plant based on sequential batch reactor (SBR) was selected for the project.

7.0 Environmental and Social Impacts

Pollution abatement projects may prove beneficial for the environment and society or they may have some adverse impacts as well. Planners and decision makers have realized the importance of understanding the consequences of any such projects on both environmental and social sectors, and have started taking steps to avoid any adverse impacts. Based on the major findings obtained from the field visits and secondary data analysis, the possible environmental and social issues with reference to the proposed sewer works in Saidpur zone is been discussed in these sections. The proposed sub-project consists of three major activities which include:

- 29 Construction of approximately 228 km long sewerage network including all required trunk/ branch/ lateral sewer.
- 30 Construction of additional STP
- 31 Construction of sewage pumping station

The construction activities would generally include earthworks (excavation, filling, shuttering, compacting), temporary diversion of existing sewer lines, civil construction (sewer lines, STP, SPS, etc) and E & M installation and commissioning.

7.1 Potential Environmental Impacts

The environmental impact of the proposed project may be categorised in two phases:

- 32 During the construction phase which would be temporary and short term;
- 33 During the operation phase which would have long term effects

The activities identified for project under each phase are:

A. Construction phase

1. Site clearing and leveling
2. Excavation & Foundation
3. Transportation of construction materials, equipments & machineries
4. Construction of ETP Units & related infrastructure

B. Operation phase

1. Operation of STP
2. Disposal of treated effluent

7.1.1 Impacts during construction phase

The impacts of construction stage activities on the various environmental parameters are examined below:

a) Impact on Air Environment

During the construction phase it is expected emissions from the diesel generator(s). Another source of air pollution is from materials transport through heavy vehicles to the site. These emissions are temporary in nature. Bulldozers, excavators, cranes, DG sets welding machines, trucks and trailers for transportation of materials will also contribute to gaseous emissions through use of diesel as a fuel. Based on the field observation of ongoing JNNRUM projects and interaction/consultation with stake-holders, it is expected that the levels of dust (RSPM and SPM), carbon mono-oxide (CO), hydrocarbons and NO_x (NO & NO₂) is likely to increase during the construction phase mainly because of:

- Excavation, backfilling, compaction activity and movement of vehicles on un-paved roads (increases dust level)

- Vehicle exhausts from construction machinery and from light and heavy vehicles for transportation of pipes and construction material like cement, etc (increases NO₂).
- Use of portable diesel generators and other fuel fired machinery (increases CO).

However, the emission of NO_x, SO₂ will be is not expected to cause any change in the ambient air quality. During pipeline laying the following activities cause air pollution:

- Emissions from equipment used for construction of the pipeline.
- Emissions of dust during excavation of soil
- □Emissions from the exhausts of vehicles used for the transport of the workers, the transport of construction materials and equipment and construction vehicles themselves

During pipeline laying, air emissions are not expected to adversely impact ambient air quality in and around project activity area. Due flat terrain good dispersion is available dispersal of the pollutants and thereby the impacts due to NO_x, SO₂ emissions during the construction will be negligible.

b) Noise levels

The proposed construction activities are expected to increase the noise levels mainly due to plying of construction vehicles, pumping machines, use of portable generators, mechanical machinery such as cranes, riveting machines, hammering etc. There will be an increase in noise levels in areas situated close to the road due to movement of trucks and construction activities. Temporary impacts may especially be felt at educational facilities like schools/colleges (NIT Patna, St. Xavier's High School, BD Public School, Indira Gandhi Planetarium, Patna Museum & High Court, hospitals (Patna Medical College & Hospital (PMCH) etc), cultural/religious centers including all temples, mosques, churches and Gurudwaras in the region. However, the impact of truck movements and construction activities on noise level in residential areas situated at 50 meter and beyond from the road will be insignificant considering the excess attenuation and will be below the stipulated standard of CPCB, i.e. 55 dB(A) during day time.

Increase of noise level at night may produce disturbances, causing sleeplessness in people in the vicinity of the site in case construction activity is extended into the night hours. As per the baseline environmental status, the noise levels in Saidpur zone are expected to be within permissible limits as the area is mostly residential and has limited commercial, and no industrial area. However, these impacts are of temporary nature, lasting only during the construction period. Traffic disruption can be expected in busy areas such as area around Bhoothnath road, Shershah marg, Saidpur Main road, Ashok rajpath etc area due to transportation of material of construction.

The proposed project sites are located in open rural areas with no major industrial activities undertaken in the vicinity of the sites. Current noise sources at the sites of the project are merely due to natural sources. Man made sources include traffic noise which was negligible in the project sites due to low traffic volumes. The construction of the treatment plant will produce significant noise levels during the construction phase. During the operation phase, noise levels are not expected to exceed current baseline measurements.

Construction activities will take place across the whole project components that include Sewerage Treatment Plant, emergency overflow pipe, lying of sewer pipe line and outfall. In general, the impact of the construction will depend on;

- The proximity of the construction activities to noise sensitive receivers (NSRs);
- The specific heavy equipment deployed; and
- The length of time over which the construction works are taken.

Typical noise emissions from various construction equipments that may be used at the project sites are summarized in table below:-

Table: 7.1- Typical Noise Emissions Of Construction Equipment

Equipment	Typical sound pressure level in dB(A) at given distance	
	15 m	240m
Air compressor	75-87	51-63
Backhoe	71-92	47-69
Compactor	72	48
Concrete mixture	75-88	51-64
Front loader	72-81	48-58
Generator	72-82	48-58
Grader	80-93	56-69
Pumps	70-90	44-66
Stone crusher	85-95	61-74
Tractors, Dozers	78-95	54-74
Trucks	83-93	59-69
Concrete vibrators	68-81	44-57

Effective noise management protocols would be implemented wherever applicable during construction and operating phases of the life of this project. Besides this protocol measures, construction work will be limited to day time periods, thus avoiding the night time which is the most noise sensitive. The following measures should be treated as a part of the project proposal which include:

- planting of buffer trees and shrubs where appropriate;
- locating noisy equipments as far as possible from NSRs;
- orienting equipment with high directivity to emit noise away from NSRs;
- switching off unnecessary or idle equipments;
- fitting of noise mufflers to mobile equipments; and
- Preventive maintenance of equipment to minimize noise emissions.

In the light of the prevailing low ambient noise levels in the area surrounding the project sites, it is inevitable that some noise disturbance will be experienced, particularly during the construction of the emergency outfall pipe. Such impacts, although temporary and therefore reversible, are assessed to be negative and low to moderate significance.

c) Impact on Land Environment

The proposed project is renovation cum augmentation of sewage treatment plant. The proposed STP is in an existing piece of land and no fresh land is required for the construction of STP. Whereas out of proposed 04 numbers of pumping stations only 01 pumping station is proposed at new locations and others to be retained as such. The total land area to be acquired for the new pumping station at Arafabad area is only 900 M2 of land parcel. Since the present project does not involve any major issues of land acquisition no major impact on land environment is anticipated. However, local land and soil may get affected during construction work as it would involve land clearing. Normally removal of vegetation and land clearing is associated with soil erosion, however these issued are localised temporary effect and associated with construction phase only. Excessive debris, trash or construction remnants (e.g. dirt piles) may create problems related to drainage, unhygienic conditions and poor aesthetics. If construction materials are handled appropriately, it may affect agricultural lands minutely.

Uncontrolled disposal of municipal solid waste generation at SPS and Sludge at STP may impact the land environment.

Since the project does not involve any private land acquisition hence, there will not be any impacts on titleholders land or structures.

d) Surface and Ground Water Hydrology

The proposed project being located near the river Ganga may result in the change in direction of the flow of surface runoff from the catchment area. However, the quantity of water reaching the river Ganga is not going to change. The project area have some small talabs & some historical ghats (Anta ghat & Krishna Ghat) near to Gandhi Maidan. However these areas are not expected to be affected as sewer lines are not planned to be laid through any of these areas. However, with other finer materials such as construction powders, fluids and greases, if not appropriately managed or in the event of an accident, there may be potential for temporary contamination of the river Ganga via the various drains and nallas, during rainfall.

e) Impact on Biological Environment

No natural forest area has been observed in the study area. There are no notified ecological sensitive locations, migratory paths, sanctuaries, etc. within the study area. As detailed out there are no endangered floral species in the study area. The proposed project does not envisage any destruction or displacement of any endemic floral or faunal species, hence the impact will be insignificant.

The Gangetic Dolphin falls under Endangered Species category as per IUCN Red list and has been included in Schedule I of the Indian Wildlife (Protection) Act 1972, is found in the Ganga stretches of Patna. However, the project area being in an existing area and being small it is not likely to affect the movement and life pattern of the species. Moreover, as the construction and operation of STP is going to result in the reduction of pollution load on the receiving water body, there is no likelihood of any negative impact on the aqua-life.

f) Impact on Socio-Economic Environment

All the activities to be carried out during construction and operation phases will require skilled and unskilled labourers, hence creating temporary as well as permanent employment for local people. As the proposed project is located within the city limit with lot of employment opportunities, it is likely to have positive socio-cultural economic impact.

g) Impact on Occupational Health and Safety

The construction of STP facilities is not going to involve the large scale construction activities; however, all the workers will be equipped with necessary personal protective equipments (PPE) and will be trained for safety aspects to be followed during working hours.

h) Environmental sensitive areas

Based on observations and findings from field visits, interaction with government officials and consultation with local residents, an assessment of the environmentally and ecologically sensitive areas was made. The area does not have any flora and fauna components which require any special attention from conservation point of view. There is no environmental sensitive area within 10 km radius of the project.

With regard to sensitive aquatic areas and water bodies, there are none. It was also observed that the major land use pattern of the area is residential, with limited agricultural and no forest areas.

There are no major tourist areas falling in the area, except the banks of river Ganga which is mainly utilized by tourists/ pilgrims for conducting aarthi Pooja or homm-havans and for having a holy bath especially during festival times. Even the river banks will not be impacted by the sewer works as, the construction and operational works will take place inside the residential areas which are away from river banks.

i) Traffic Congestion

Due to the excavation work which will take place on the main roads of the city, there will be a disturbance in the traffic movement. People may suffer some inconvenience during the morning and evening peak hours. Traffic disruption can be expected in busy areas such as area around Ashok Rajpath, Bazar Samiti, Rajendra Nagar etc area due to transportation of material of construction. Also many of the roads in many pockets of the district are very narrow some ranging from 7 -12 ft. wide. Any excavation along the roads in these areas will inhibit traffic movement. Temporary inconveniences caused by construction if the project is implemented in a timely manner. However, the same interviewees felt that they had little confidence in the ability of the agency to execute a project in an efficient manner. They had grievances with the long duration of construction work.



Figure 7-1: Dense market roads causing traffic congestion due to construction work

j) Impact on existing utility services

The road opening activities may damage the underground water pipelines or electricity poles in the vicinity of the site for the proposed sub-projects. This will lead to water supply interruptions, disruption in electricity supply and will involve expensive repair costs. For sewerage works in the entire city, flooding could be an issue during the monsoons, especially in the congested regions like in and around Shahgunj, Kadam Kuan, Rajendra Nagar etc areas. This issue may further aggravate due to blocked drains and poor solid waste management in the city.

7.1.2 Impacts during operation phase

The impacts of operation stage activities on the various environmental parameters are examined below:

a) Air Environment

As the STP does not involve any type of unit operations releasing the gaseous emissions, hence, the impact on ambient air quality is not going to be affected.

b) Water environment

Water resources in the project area would be the most positively benefited. The probably environmental impacts related to water during operation stage may include unpredictable events such as:

- 34 Temporary flooding of adjacent areas due to accidental leakages/bursts and also due to blockages and backloging of lines.
- 35 Water pollution and possibility of mixing with water supply line due to leakages/ overflows from the sewer lines
- 36 Impairment of receiving water quality in surface/sub-surface source due to inadequate /inefficient sewage treatment process.

c) Noise quality

Improper handling and irregular maintenance of operating machines including pumps, generators, air diffusers, etc may lead to increased noise pollution during operation activity.

d) Impact on Occupational Health and Safety

As the operation of STP facilities involve handling and use of chemicals such as Lime, Poly electrolyte, Urea, DAP etc. the safety of workers invites safety considerations. As the workers will be equipped with necessary personal protective equipments (PPE) and will be trained for safety aspects to be followed during working hours, the impact will be insignificant as a whole. However, the guidelines of CPCB for health and safety of workers at Effluent Treatment Plant will be strictly adhered to.

7.2 Conclusion

Consultations with relevant officials including concerned officials, Revenue Department, community, other sources and first-hand observations during the field visit no additional land is required for the project, as land is available for construction of proposed STP and also sewage construction will not result in fresh land acquisition. Also there are no squatters and encroachers present in and around the STP premises. Thus, given that there is no land acquisition, there are no R&R issues related to land acquisition, including but not limited to loss of property, resettlement, land regulations, etc. Sewer lines will pass through various residential colonies of sewerage zone. Moreover there would be no loss of community assets during the construction as noticed during field survey and consultation with the local people. Loss of access in temporary manner would be compensated by local mitigation measures as discussed later in the report. Based on the overall secondary data analysis and field investigation, the proposed project is expected to benefit the Patna City, as the wastewater that currently flows untreated into the Ganga river will be captured, treated and the remainder of the treated effluent will be allowed to flow into the river. The likely beneficial impacts of the projects include:

- 37 Improvement in sewerage collection and treatment within the cities/towns
- 38 Prevention of storm drains carrying sanitary sullage or dry weather flow
- 39 Prevention of ground water and soil pollution due to infiltration of untreated liquid waste
- 40 Prevention of discharge of untreated sewage into River Ganga
- 41 Improvement in water quality of River Ganga, a national resource
- 42 Improvement in environmental sanitation health and reduction in associated health hazards within the cities/towns
- 43 Improvement in quality of life, human dignity and increased productivity
- 44 Reduced nuisance of open defecation due to low cost sanitation and reduced malarial risks and other health hazards.

8.0 MITIGATION AND MANAGEMENT PLAN

8.1 Environmental Management Plan

Summarizes the generic environmental management plan for low category investment that identifies the potential issues of various activities that are anticipated in the design and development, construction, and operation phases of the proposed sewer work and STP in Saidpur area Patna. The Project Components Includes:

- a) Saidpur STP of 60 mld;
- b) Sewerage network in Zone-III + Sewerage Network in Zone-IV (N) = 172.50 km
- c) Saidpur STP Area- 55.10 Km

The environmental management plan ensures to suggest appropriate mitigation measure against the issues/ concerns identified during the environmental and social assessment study.

In general, the BUIDCO (with assistance from DBO Operator and Independent Engineer/Supervision Consultant) is the responsible entity for ensuring that the mitigation measures as suggested in the ESMP. The roles and responsibilities of the involved institutes are described below.

8.1.1 Implementation of EMP Specific activities by BUIDCO

The role of BUIDCO in the implementation of EMP involves the following activities:

- EIA clearance from NGRBA and World Bank;
- CTO Certificate from Bihar State Pollution Control Board for STP.
- Disclosure of EIA document as well as in the info shop of World Bank and
- Permission from line department for laying of networking, renovation of STP & completion of construction work of sewerage system.
- Permission for tree felling (if any) ;
- Advising contractor for necessary environmental monitoring of Air, Water, Noise and Soil Quality during the construction Operation phase.

8.1.2 Specific activities by Design Built Operate (DBO) Operator

The operator shall implement the mitigation measures as recommended in EMP attached to the bid document.

8.1.3 Implementation of EMP

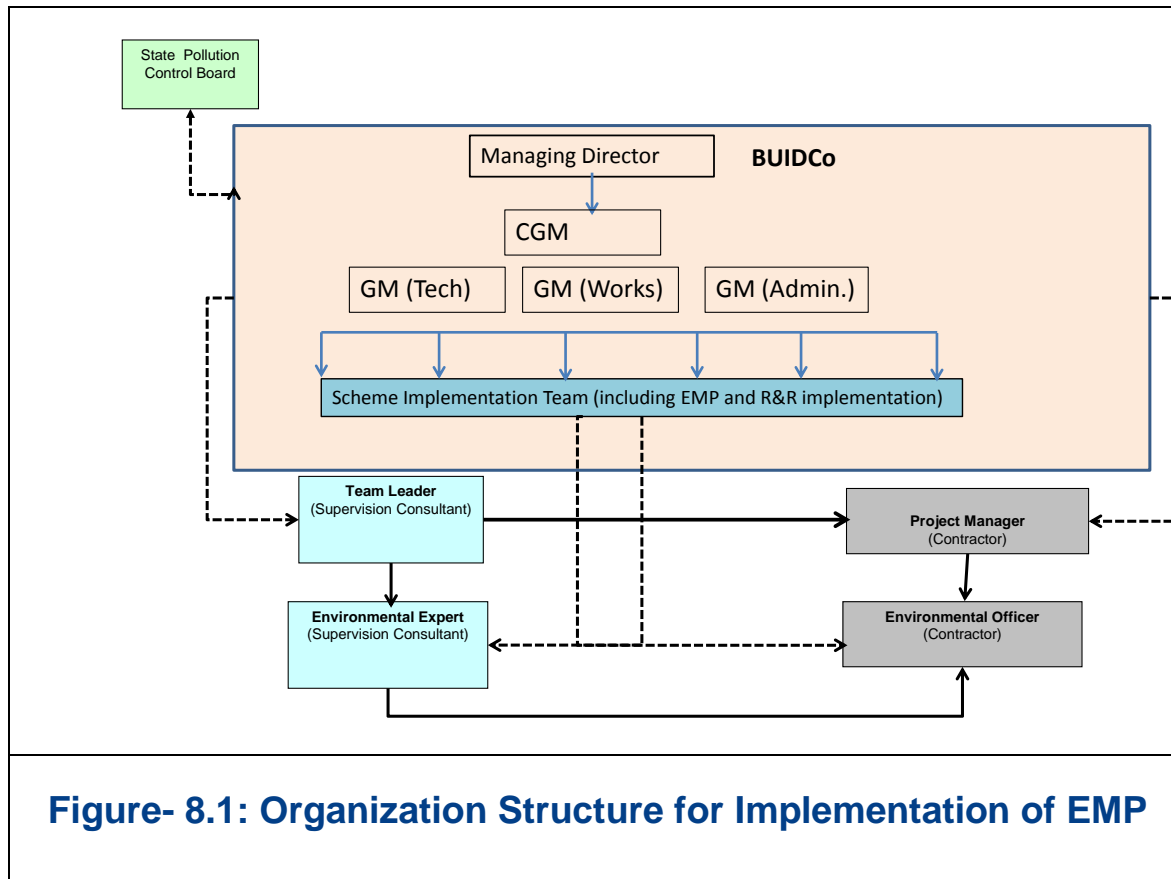
The DBO Operator shall have prime responsibility to implement the EMP. "The DBO engineer" shall monitor the compliance of the EMP. DBO engineer and BUIDCo will have secondary responsibility for implementation of EMP.

The Operator shall ensure that:

- Ensure that sewer laying process does not create hazardous movement situation. Also ensure that public is pre-warned about the activities, construction area is barricaded, all debris is well managed causing minimum inconvenience to public and other measures are implemented as indicated under EMP.
- Specific area shall be earmarked for intermittent storage of biodegradable and non-biodegradable waste at SPS site.
- Tree plantation (minimum two row) shall be made on the periphery of SPS to prevent spread of

bad odour and undertake landscaping to enhance aesthetic at SPS locations.

Feedback from the local residents can also be taken from time to time to cross check the contractor's report. Project management consultants should make inspection visits at construction site to check the implementation of Environment Management Plan as per the contract. Broad Institutional arrangement for implementation of EMP is shown in figure 8.1 below:



The Environmental Management Plan during the Design, Construction and Operation stages of the project are given in table 8.1, 8.2 and 8.3 for Saidpur STP, Saidpur Sewerage zone- III and Saidpur sewerage zone -IV (N) respectively.

Table 8.1: Environmental Management Plan for Saidpur STP Project (60 MLD)

Activity		Potential Negative Impact/Concern	Duration of impact	Mitigation Measures	Responsible agency
A. Design and Development Phase					
Sewage Treatment plant	Treated water disposal into nearby stream	<ul style="list-style-type: none"> Pollution of received water body (river) or land due to inefficient treatment or non-operation of STP 	Temporary	<ul style="list-style-type: none"> The treated water quality shall comply with the prescribed standards of the bid document and other applicable conditions of consent to establish issued by the state pollution control board. Selection of best available sewage treatment technology with High BOD removal efficiency. Ensuring development and compliance to standard operation and maintenance practices. Provision of effective screening at inlet of STP for removal of grit, fine plastics and other suspended solids Provision of effective separation and controlled disposal of digested sludge Provision effective disinfection before discharge of treated water for irrigation or to river 	DBO Operator
	STP Breakdown	<ul style="list-style-type: none"> Discharge of untreated sewage leading river pollution. 	Temporary	<ul style="list-style-type: none"> Provision of adequate holding capacity adequate for storage of sewage to prevent flow of untreated sewage to river. 	DBO Operator

	Flooding due to rain water run off	<ul style="list-style-type: none"> Rain water may flood the STP area in absence of adequate provision of diverting rain water flow towards STP from periphery area. 	Temporary	<ul style="list-style-type: none"> Suitable drainage provision shall be made to divert the rain water likely to be accumulated from peripheral catchment area of STP, to natural drainage stream or area. 	DBO Operator
	Sludge disposal	<ul style="list-style-type: none"> Disposal of sludge leading to contamination of land and water. 	Permanent	<ul style="list-style-type: none"> Efficient Sludge dewatering with minimum land involvement shall be adopted. Provision shall be made for intermittent storage of digested sludge at STP site. The digested sludge shall be utilised as manure or disposed to suitable site as approved by DBO engineer. If disposal is made for land fill, the site shall be located away from habitation and water bodies and shall be pre-approved by concerned authorities like Municipal corporation, Pollution Control Board or urban development authority. 	DBO Operator
	Provision for safety of workers and safe operation of STPs	<ul style="list-style-type: none"> Accidents leading to injury or death of workers (Fall of workers from Height, Fall into deep water tanks, Short Circuiting) Accidental slip, trip and fall in walk ways or work areas 	Permanent	<ul style="list-style-type: none"> Ensure adequate provision of Handrails on both sides of walkways close to deeper tanks and STPs need to be ensured; All electric switches (including unit specific on-off switches installed at respective units) and panels should 	DBO Operator

		<ul style="list-style-type: none"> • Fire • Exposure to toxic gas such as chlorine 		<p>have adequate protection from rain water to prevent short circuiting</p> <ul style="list-style-type: none"> • Proper earthing with installation of earth circuit breakers shall be made • Walk ways designs shall be made with proper slope to avoid accumulation of rain water. Material handling and storage shall be so designed that walk way surface remains free from wet or oil surface situation to prevent slips, trip or fall accidents. • Provision of interlock system to either stop STP or divert untreated effluent to holding tanks in case of short circuiting, or mall functioning of STP • Prepare emergency preparedness plan including identification of assembly area in case of fire 	
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	Location of STP	<ul style="list-style-type: none"> Noise/Odour/fly nuisance hazards to neighbouring areas. Cutting of Trees 	Permanent	<ul style="list-style-type: none"> Ensure minimum noise generation; at pump station in STP Minimize Tree cutting if involved. Tree plantation of at least two rows around the periphery of STP site and landscaping to prevent spread of bad odour with large canopy/ broad leaves trees like Sesum, Neem, Bargad, Teak, Sal, etc. Accumulated sludge and solid waste to be cleared within 24 hours and spraying of suitable herbicides on accumulated sludge/solid waste to reduce odour. 	DBO Operator
B. Construction phase					
Sewage treatment plant	Excavation	Loss of topsoil due to excavation activities.	Temporary	<ul style="list-style-type: none"> The existing STP shall not be demolished till alternate arrangement for treatment of existing sewage is made to ensure that untreated sewage is not discharged to river. Excavation shall be planned in such a manner that such that no damage occurs to existing structures. Top soil should be separately stockpiled and utilized for green belt development or landscaping after completion of work 	DBO Operator

		Construction waste	Temporary	<ul style="list-style-type: none"> All the associated construction waste should be properly managed by storing and disposing off at suitable refusal sites approved by DBO engineer. 	DBO Operator
		Nuisance due to domestic solid waste disposal	Temporary	<ul style="list-style-type: none"> Provide two bins for recyclable and non-recyclable wastes. Ensure that recyclable and non-recyclable wastes are collected in segregated manner in these bins before disposal. Recyclable material should be sold. Non-recyclable material should be disposed to designated land fill area of the city. Provide adequate sanitation facility for workers at construction sites. 	DBO Operator
		Dust Generation due to construction activities	Temporary	<ul style="list-style-type: none"> Excavated material transported by trucks will be covered and/or wetted to prevent dust nuisance. Suppressing dust generation by spraying water on stockpiles and unpaved movement areas Water sprinkling over excavated areas, unpaved movement areas and stockpiles. Transportation of loose construction material through covered trucks. 	<ul style="list-style-type: none"> DBO Operator

				<ul style="list-style-type: none"> • Use dust curtains (polysheets/ sheets) around the construction area for containing dust spread. • Construction equipment must comply with pollution norms and carry Pollution Under Control certificate. 	
		Temporary flooding due to uneven dumping of construction waste	Temporary	<ul style="list-style-type: none"> • The construction waste material should be stored on the higher areas of the site and or areas where water may accumulate creating flooding like situation 	DBO Operator
		Spillage of fuel and oil	Temporary	<ul style="list-style-type: none"> • Care to be taken to store fuel and oil (if required) at a place away from any drainage channel/nalla preferably to be stored in drums mounted on a concrete paved platform with slop draining to small spills collection pit. 	DBO Operator
		Noise and vibration disturbances to residents and businesses	Temporary	<ul style="list-style-type: none"> • Construction activities to be carried out in day time with prior intimation to local residents and shop keepers. • Use of low noise and vibrating equipment (such as enclosed generators with mufflers, instruments with built in vibration dampening and improved exhaust), to meet standards as prescribed by CPCB7. 	DBO Operator

⁷ <http://moef.gov.in/citizen/specinfo/noise.html>

				<ul style="list-style-type: none"> • Provision of protective equipment (PPE) like ear muffs and plugs for construction workers. . • Provision of noise barriers as feasible in inhabited areas, particularly near sensitive zones like hospitals, schools etc. • DG set to be fitted acoustic enclosure. 	
Construction camps	Sanitation	Nuisance due to absence of facility of sanitation and solid waste management	Temporary	<ul style="list-style-type: none"> • Labour camp if provided, must have adequate provision of shelter, water supply, sanitation and solid waste management 	DBO Operator
General: safety during construction	Safety and Health Hazard	Safety hazards to labours and public. Workers are seen to working without any PPE even at height.	Temporary	<ul style="list-style-type: none"> • Comply with the Occupational health and Safety act of India • Ensure that the contact details of the police or security company and ambulance services nearby to the site. • Ensure that the handling of equipment and materials is supervised and adequately instructed. • Follow safe practices for working at height or confined area or underground working for safety of workers • Erect warning signs/ tapes and temporary barriers and/or danger tape, marking flags, lights and flagmen around the exposed construction works warn the public and traffic flow of the inherent dangers. 	DBO Operator

				<ul style="list-style-type: none"> • Provide adequate PPE to workers such as helmets, safety shoes, gloves, dust masks, gumboots, etc. to workers • Provide handrails on both sides of walkways close to deeper tanks and STPs need to be ensured; • Smaller on and off switches at STP units to be installed with protection from rain water to minimize electrical short circuit; • Monthly reporting of all accidents and immediate reporting to DBO engineer and owner. 	
C. Operation phase					
Sewage treatment plant	Treatment and Disposal of Treated Water and Sludge	River, land or ground water pollution due to discharge of untreated or partially treated sewage due to inadequate or inefficient STP operations.	Temporary	<ul style="list-style-type: none"> • Monitor the treated sewage quality and ensure compliance with PCB standards for effluent disposal into surface water bodies, on land or for the agricultural use. • Follow standard operating procedures for operation and maintenance. • Undertake periodic audit as per these procedures. • Comply with all applicable condition of consent to operate • Quarterly monitoring of influent sewage, treated sewage, upstream and downstream point of treated sewage disposal point to river 	DBO Operator

		Problems arising due to bad odour, insects, polluted air,	Temporary	<ul style="list-style-type: none"> • Maintain the green belt as per provision of design to prevent spread of bad odour with large canopy/ broad leaves trees like Sesum, Neem, Bargad, Teak, Sal, etc. • Accumulated sludge and solid waste to be cleared within 24 hours and spraying of suitable herbicides on accumulated sludge/solid waste to reduce odour. • Quarterly monitoring of Ambient Air Quality with respect to PM10, PM2.5, Sox and NOx, CO and Odour at three locations (at STP site, minimum 500 m away from STP site in up-wind and down-wind direction of STP area. 	DBO Operator
		Increase in Ambient Noise Level and discomfort to neighbouring people	Temporary	<ul style="list-style-type: none"> • Proper handling and regular maintenance of operating machines including pumps, generators, air diffusers, etc. • Quarterly Monitoring of Ambient Noise level to check compliance to standards. • Quarterly monitoring of ambient noise levels (day and night) at same locations as of ambient air monitoring 	DBO Operator

		Indiscriminate disposal of sludge leading to contamination of land and soil.	Temporary	<ul style="list-style-type: none"> • Prepares sludge disposal plan as per desire stage provisions and guidelines and adhere to the same. • Ensure proper functioning of STP for digestion of sludge and ensure adequate functioning of dewatering units for efficient functioning of system 	DBO Operator
		River, land or ground water pollution due to discharge of untreated or partially treated sewage due to inadequate or inefficient STP operations.	Temporary	<ul style="list-style-type: none"> • Ensure compliance with PCB standards for effluent disposal into surface water bodies, on land or for the agricultural use. • Follow standard operating procedures for operation and maintenance. • Undertake periodic audit as per these procedures. • Comply with all applicable condition of consent to operate 	DBO Operator
General Safety	Workers exposure to hazardous materials/situations	<ul style="list-style-type: none"> • Serious/health/ safety hazards 	Temporary	<ul style="list-style-type: none"> • Ensure availability of PPE for maintenance workers. • Follow safety measures and Emergency preparedness plan evolved at design stage 	DBO Operator

Table- 8.2: Environmental Management Plan for Saidpur Sewerage Network (Zone III)

Activity		Potential Negative Impact/Concern	Duration of impact	Mitigation Measures	Responsible Agency
Sewerage and Sanitation Investments					
A. Design and Development Phase					
Sewerage Network (Trunk Sewer Line)	Accidental leakages/ bursts	<ul style="list-style-type: none"> Due to accidental burst or leakage of sewers, flooding of the nearby areas Backlogging due to unexpected heavy flow rates 	Temporary	<ul style="list-style-type: none"> Designing sewers with adequate capacity and flow velocity Provision for Regular inspection and maintenance of the sewers Preparation of safety and Emergency Preparedness plan	DBO Operator
Sewage Pumping Station	Location of Sewage Pumping Station and Pumping of sewage to STP	<ul style="list-style-type: none"> Noise and odour nuisance hazards to neighboring areas. Cutting of Trees 	Permanent	<ul style="list-style-type: none"> Ensure minimum noise generation at pump station in SPS by use of less noise generating equipment meeting prescribed noise standards as applicable and enclosed generators. Minimize Tree cutting if involved. Tree plantation of at least two row around the periphery of SPS site and landscaping to prevent spread of bad odour with large canopy/ broad leaves trees like Sesum, Neem, Bargad, Teak, Sal, etc. Accumulated sludge and solid waste to be cleared at short intervals and spraying of suitable herbicides on accumulated sludge/solid waste to reduce odour. Provision for regular maintenance and switching off equipment when not in use;	DBO Operator

B. Construction phase						
Sewerage (laying of sewers) and Sewage Pumping station	Excavation, cutting, back filling, compaction and construction operations	Damage to underground utilities like water, gas line, electricity and telephone conduits, etc. due to construction activities.	Temporary	<ul style="list-style-type: none"> Identify existing underground other utility structures, lines through available records and in consultation with concerned authorities and plan construction activities accordingly to minimize damage to such utilities. These underground utilities encountered in excavating trenches carefully shall be supported, maintained and protected from damage or interruption of service until backfill is complete and settlement has taken place. 		DBO Operator
		Accidents/ damages due to erosion/ sliding of vertical sides of excavated trenches while places the pipes	Temporary	<ul style="list-style-type: none"> Maintaining the excavation by Shoring trench sides by placing sheeting, timber shores, trench jacks, bracing, piles, or other materials Exposed surface shall be resurfaced and stabilized. Exposed surface will be resurfaced and stabilized by making the sloping sides of trench to the angle of repose at which the soil will remain safely at rest. 		DBO Operator
		Generation of substantial debris, top soil and muck during construction	Temporary	<ul style="list-style-type: none"> Top soil shall be preserved and may be used for agricultural purpose or development of city parks. Soil and debris may be managed for planned land filling and landscaping; Debris may be suitably stored to filling back the excavated areas after placing the trunk sewer lines. 		DBO Operator
		Dust Generation (Air Pollution) due to excavation, cutting, back filling and compaction operations	Temporary	<ul style="list-style-type: none"> Water sprinkling over excavated areas, unpaved movement areas and stockpiles. Transportation of loose construction material through covered trucks. Use dust curtains (polysheets/ sheets) around the construction area for containing dust spread at SPS building construction site. 		DBO Operator

Table- 8.3 : Environmental Management Plan for Saidpur Sewerage Network Project Zone-IV (N)

				<ul style="list-style-type: none"> Construction equipment must comply with pollution norms and carry Pollution Under Control certificate. 	
Activity		Potential Negative Impact/Concern	Duration of impact	Mitigation Measures	Responsible Agency
Sewerage and Sanitation Investments				during vacations and work near hospitals to be completed on priority basis (in shorter time period with alternate provision of	
A. Design and Development Phase					
Sewerage Network (Trunk Sewer Line)	Accidental leakages/bursts	<ul style="list-style-type: none"> Due to accidental burst or leakage of sewers, flooding of the nearby areas Backlogging due to unexpected heavy flow 	Temporary	<ul style="list-style-type: none"> Designing sewers with adequate capacity and flow velocity Provision for Retentive equipment (PPE) like manholes and plugs for construction safety and Emergency Preparedness plan Provision of noise barriers in inhabited areas, particularly near sensitive zones like hospitals, schools etc. DG set to be fitted acoustic enclosure. 	DBO Operator
		Temporary flooding due to excavation during monsoons or blockage of surface drains and odour nuisance hazards to	Temporary	<ul style="list-style-type: none"> Stockpiled areas to be bordered by berms; Stockpiles to be done in high areas to avoid flow in storm water run-off channels and erosion; 	DBO Operator
Sewage Pumping Station	Location of Sewage Pumping Station and Pumping of sewage to STP	Increased noise and odour nuisance hazards to surrounding areas. traffic congestion, longer travel times, blockage of access)	Permanent	<ul style="list-style-type: none"> Ensure minimum noise generation at pump station in SPS by use of less noise generating equipment meeting prescribed noise standards as applicable and use of silencers 	DBO Operator
		Increased noise and odour nuisance hazards to surrounding areas. traffic congestion, longer travel times, blockage of access)	Temporary	<ul style="list-style-type: none"> Minimize traffic during construction. Proper traffic planning be made Tree plantation of at least two row around the periphery of SPS site Work scheduling to prevent stoppage of local bus with large canopy placed to avoid trees like Sesuv, Neem, Bargad, Teak, Sal, etc. Secure storage of large and solid waste to garbage and trash bins and spraying of hospitals. Safe sides shall be maintained during solid waste during construction. Provide regular maintenance and servicing of equipment on facility to normal life and business 	DBO Operator

B. Construction phase					
Sewerage (laying of sewers) and Sewage Pumping station	Excavation, cutting, back filling, compaction and construction operations	Damage to underground utilities like water, gas line, electricity and telephone	Temporary	<ul style="list-style-type: none"> Identify existing underground other utility structures, lines through available records and in consultation with concerned authorities and plan construction activities accordingly to minimize damage to such utilities. These underground utilities encountered in any drainage channel/nalla preferably to be stored in drums mounted on a concrete paved platform with slop draining to small spoils collection pit. 	DBO Operator
		Spillage of fuel and oil due to construction activities.	Temporary	Care to be taken to store fuel and oil (if required) at a place away from excavating trenches carefully shall be supported, maintained and protected from damage or interruption of service until backfill is complete and settlement has taken place.	DBO Operator
		Nuisance due to solid waste disposal	Temporary	<ul style="list-style-type: none"> Provide two bins for recyclable and non-recyclable wastes. 	DBO Operator
		Accidents/ damages due to erosion/ sliding of vertical sides of excavated trenches while places the pipes	Temporary	<ul style="list-style-type: none"> Ensure that recyclable and non-recyclable waste are collected in segregated manner, in these bins before disposal. Recyclable material should be sold. Non-recyclable material should be disposed for designated land fill area of the city. Exposed surface shall be resurfaced and stabilized. Exposed surface will be resurfaced and stabilized by making the sloping sides of trench to the angle of repose at which the soil will remain safely at rest. 	DBO Operator
General: safety during construction	Accidents	Safety hazards to labours and public	Temporary	<ul style="list-style-type: none"> Comply with the Occupational health and Safety act of India 	DBO Operator
		Generation of substantial debris, top soil and muck during construction	Temporary	<ul style="list-style-type: none"> Ensure that the contact details of the police or security company and ambulance services nearby to the site. Top soil shall be preserved and may be used for agricultural purpose or development of city parks. Ensure that the handling of equipment and materials is supervised and adequately instructed. Direct warning signs/ tapes and temporary barriers and/or danger tape marking flags, lights and flagmen around the exposed areas after placing the trunk sewer lines. 	DBO Operator
		Dust Generation (Air Pollution) due to excavation, cutting, back filling and compaction operations	Temporary	<ul style="list-style-type: none"> Construction works warn the public and traffic flow of the inherent dangers. Water sprinkling over excavated areas, unpaved movement areas and stockpiles. Provide adequate safety precautions such as helmets, safety shoes, gloves, dust masks, gumboots, etc. to workers Transportation of loose construction material through covered trucks. Monthly reporting of all accidents and immediate reporting to DBO engineer and owner. Use dust curtains (polysheets/ sheets) around the construction area for containing dust spread at SPS building construction site. 	DBO Operator

C. Operation phase				<ul style="list-style-type: none"> Construction equipment must comply with pollution norms and carry Pollution Under Control certificate. 	
Sewer line	Leakage/overflows	Water pollution and possibility of mixing with water supply line	Temporary	<ul style="list-style-type: none"> Regular monitoring of sewer line and manholes for visible leakages/ overflows. 	DBO Operator
		Water supply line vibration disturbances to residents and businesses	Temporary	<ul style="list-style-type: none"> Construction activities to be carried out in day time with prior intimation to local residents and shop keepers. Immediate repair shall be carried out to plug the leakages. Restore the sewer and other utility services if damaged due to leakages. Construction work near schools and colleges to be carried out during vacations and week near hospitals to be completed on priority basis (in shorter time period with alternate provision of traffic accessibility of exit/entry gates etc.) 	DBO Operator
Sewage Pumping Station	Waste Handling	Bad odour, Health hazard and public nuisance	Temporary	<ul style="list-style-type: none"> Provision for regular clearance of sludge and solid waste on priority basis (in shorter time period with alternate provision of traffic accessibility of exit/entry gates etc.) Ensure maintenance of Green belt as planned Periodic disposal of accumulated sludge/solid waste to disposal site as approved by DBO engineer. Provision of protective equipment (PPE) like ear muffs and plugs for construction workers. 	DBO Operator
General Safety	Workers exposure to toxic gases in sewers and hazardous materials during sewer maintenance work	<ul style="list-style-type: none"> Serious/health/ safety hazards The toxic gases are likely to contract common debilitating diseases 	Temporary	<ul style="list-style-type: none"> During construction/ maintenance operation, the sewer line will be provisionally closed to ensure that inhabited areas and public places near sewer line like hospitals, schools etc. are not exposed to the risk of gas leakage. Access to be filled at public nuisance workers. 	DBO Operator
		Temporary disabling cases to excavation exposure to during monsoon or blockage of sewerage	Temporary	<ul style="list-style-type: none"> Soil safety and Emergency Preparedness plan prepared at design stage Excavation to be done in high areas to avoid flow in storm water Monthly reporting of all accidents and immediate reporting to DBO engineer and owner. 	DBO Operator
		Increased traffic inconvenience (emissions, congestions, longer travel times, blockage of access)	Temporary	<ul style="list-style-type: none"> Alternate traffic routing must be adopted in consultation with concerned traffic police authorities. Proper traffic planning be made for narrow lane areas. Work should to be completed on priority near business and market place to minimize business loss. Care should be taken to minimize congestion and negative impacts at schools and hospitals. Safe access shall be maintained to these places during construction. Provide temporary crossing/ bridges as may be required to facilitate normal life and business 	DBO Operator

		Settlement of backfilled area after construction	Temporary	<ul style="list-style-type: none"> The backfilling material shall be free from petroleum products, slag, cinders, ash or other material. Backfilling activity shall be completed within five days of laying of sewer. Proper compaction as per the soil condition and retain the original level of alignment and grade. 	DBO Operator
		Spillage of fuel and oil	Temporary	Care to be taken to store fuel and oil (if required) at a place away from any drainage channel/nalla preferably to be stored in drums mounted on a concrete paved platform with slop draining to small spills collection pit.	DBO Operator
		Nuisance due to solid waste disposal	Temporary	<ul style="list-style-type: none"> Provide two bins for recyclable and non-recyclable wastes. Ensure that recyclable and non-recyclable waste are collected in segregated manner in these bins before disposal. Recyclable material should be sold. Non-recyclable material should be disposed for designated land fill area of the city. Provide adequate sanitation facility for workers at construction sites. 	DBO Operator
General: safety during construction	Accidents	Safety hazards to labours and public	Temporary	<ul style="list-style-type: none"> Comply with the Occupational health and Safety act of India Ensure that the contact details of the police or security company and ambulance services nearby to the site. Ensure that the handling of equipment and materials is supervised and adequately instructed. Erect warning signs/ tapes and temporary barriers and/or danger tape, marking flags, lights and flagmen around the exposed construction works warn the public and traffic flow of the inherent dangers. Provide adequate safety precautions such as helmets, safety shoes, gloves, dust masks, gumboots, etc. to workers <p>Monthly reporting of all accidents and immediate reporting to DBO engineer and owner.</p>	DBO Operator

C. Operation phase					
Sewer line	Leakage/ overflows	Water pollution and possibility of mixing with water supply line	Temporary	<ul style="list-style-type: none"> Regular monitoring of sewer line and manholes for visible leakages/ overflows. <p>Immediate repair shall be carried out to plug the leakages. Restore the sewer and other utility services if damaged due to leakages.</p>	DBO Operator
Sewage Pumping Station	Waste Handling	Bad odour, Health hazard and public nuisance	Temporary	<ul style="list-style-type: none"> Provision for regular clearance of sludge and solid waste to minimize odor nuisance Ensure maintenance of Green belt as planned <p>Periodic disposal of accumulated sludge/solid waste to disposal site as approved by DBO engineer.</p>	DBO Operator
General Safety	Workers exposure to toxic gases in sewers and hazardous materials during sewer maintenance work	<ul style="list-style-type: none"> Serious/health/ safety hazards The toxic gases are likely to contract communicable diseases from exposure to pathogens present in the sewage. 	Temporary	<ul style="list-style-type: none"> During cleaning/ maintenance operation, the sewer line will be adequately vented to ensure that no toxic or hazardous gases are present in the line. Ensure availability of PPE for maintenance workers. Follow safety and Emergency Preparedness plan prepared at design stage <p>Monthly reporting of all accidents and immediate reporting to DBO engineer and owner.</p>	DBO Operator

8.2 Environmental Monitoring Plan

The Environmental Monitoring Programme has been detailed out in Table: 8-2. Successful implementation of the Environmental Monitoring Program is contingent on the following:

- The Project Management Consultant (PMC) along with BUIDCO to request the Contractor to commence all the initial tests for monitoring (i.e. for Air, Water Quality and Noise Levels) early in the Contract to establish 'base' readings (i.e. to assess the existing conditions prior to effects from the Construction activities being felt);
- The PMC along with BUIDCO to request the Concessionaire / Contractor to submit for approval a proposed schedule of subsequent periodic tests to be carried out;
- Monitoring by the PMC's Environmental Officer of all the environmental monitoring tests, and subsequent analysis of results;
- Where indicated by testing results, and any other relevant on-site conditions, PMC to instruct the Concessionaire / Contractor to:
 - Modify the testing schedule (dates, frequency);
 - Modify (add to or delete) testing locations;
 - Verify testing results with additional testing as/if required;
 - Require recalibration of equipment, etc., as necessary; and,
 - Request the Concessionaire to stop, modify or defer specific construction equipment, processes, etc., as necessary, that are deemed to have contributed significantly to monitoring readings in excess of permissible environmental "safe" levels.

8.3 EMP Budget

The environmental budget for the various environmental management measures proposed in the ESMP is detailed in Table 8-3 and the cost of the Environmental Monitoring is given in Table 8-4. There are several other environmental issues that have been addressed as part of good engineering practices, the costs for which have been accounted for in the Engineering Cost. The rates adopted for the budget has been worked out on the basis of market rates and the Schedule of rates. Various environmental aspects covered/will be covered under engineering costs are listed below:

- Proper drainage arrangements to prevent water stagnation/ flooding in SPS site area
- Appropriate siting, and enclosing within building to reduce noise and odor nuisance to surrounding area Drainage along the ghats to collect the discharge from the residents and connecting to city sewer
- Alternate traffic re-routing,
- Ensuring storage of excavated soil material on the higher lying areas
- Solid Waste Management

Table:8.4- Environmental Monitoring Plan

Env. Component	Stage	Institutional Responsibilities					
		Parameter	Standards/ Methods	Locations	Frequency	Implementation	Supervision
Air Quality	Construction	PM10 µg /m3, PM2.5 µg/m3, SO2, NOX, CO	CPCB	Sewer Construction Sites, SPS & STP	Once in every season (except monsoon	Contractor through approved monitoring agency/Lab	PMC, BUIDCO and SPMG
	Operation	PM10 µg /m3, PM2.5 µg/m3, SO2, NOX, CO		Sewer Construction Sites,SPS & STP	Once in a year except monsoon for first 5 years.	Contractor through approved monitoring agency/Lab	PMC, BUIDCO and SPMG
Meteorology	Construction	Rainfall, humidity, Wind Speed, Wind direction, Temperature	USEPA's Meteorological Monitoring Guidance for Regulatory Modeling Applications	One location within PATNA district	Once in every season	Contractor through approved monitoring agency/Lab	PMC, BUIDCO and SPMG
	Operation	Rainfall, humidity, Wind Speed, Wind direction, Temperature	USEPA's Meteorological Monitoring Guidance for Regulatory Modeling Applications	One location within Patna district	Once in a year	Contractor through approved monitoring agency/Lab	PMC, BUIDCO and SPMG
	Construction	Leq dB (A) (Day and Night) Average and Peak values		Sewer Construction Sites, , SPS & STP	Once in every season (except monsoon)	Contractor through approved monitoring agency/Lab	PMC, BUIDCO and SPMG

Leq dB (A) (Day and Night) Average and Peak values		Sewer Construction Sites, , SPS & STP	Once in a year except monsoon for first 5 years.	Contractor through approved monitoring agency/Lab	PMC, BUIDCO and SPMG
Physical Parameter: Texture, Grain Size, Gravel, Sand, Silt, Clay; Chemical Parameter: pH, Conductivity, Calcium, Magnesium, Sodium, Nitrogen, Absorption Ratio	Consider the following methods: IS-2720 (Various part); Soil Chemical Analysis by M.L. JACKSON. Soil Test Method by Ministry of agriculture	Sewer Construction Sites , SPS & STP	Once in every season	Contractor through approved monitoring agency/Lab	PMC, BUIDCO and SPMG
Physical : Texture, Grain Size, Gravel, Sand, Silt, Clay; Chemical Parameter: pH, Conductivity, Calcium, Magnesium, Sodium, Nitrogen, Absorption Ratio	Consider the following methods: IS-2720 (Various part); Soil Chemical Analysis by M.L. JACKSON. Soil Test Method by Ministry of agriculture	Along sewer construction sites, SPS & STP	Twice in a year (Pre-monsoon and Post monsoon) for first 5 years,	Contractor through approved monitoring agency/Lab	PMC, BUIDCO and SPMG
Physical Parameter: Chemical Parameter	Consider the following methods:	Sewer Construction	Once in every season	Contractor through approved monitoring agency/Lab	PMC, BUIDCO and SPMG

BOD, COD, DO,; pH, MLSS, MLVSS Conductivity, Turbidity, color.	Standard water quality parameters as per IS 2291 and As specified by Bihar State Pollution Control Board in Consent Order	Sites , SPS & STP			
	Consider the following methods: Standard water quality parameters as per IS 2291 and As specified by Bihar State Pollution Control Board in Consent Order	Along sewer construction sites, SPS & STP	Twice in a year (Pre-monsoon and Post monsoon) for first 5 years,	Contractor through approved monitoring agency/Lab	PMC, BUIDCO and SPMG

Table: 8.5 - EMP Budget

Phase	Component of EMP	Mitigation measure	Cost included in the DPR (Yes/no/not clear)	Cost in Rupees (or Details if provided in DPR)	Remarks
Design and Development	Provision for accidental leakages / bursts in SPS,STP	Proper drainage arrangements to prevent water stagnation/ flooding in SPS site area & STP	Yes (not specific but included as a part of associated construction activity)	DPR for Sewerage system in Sewerage District Patna,	The proposed DPR includes these activities
	Location of SPS,STP	Appropriate siting, and enclosing within building to reduce noise and odour nuisance to surrounding area	Yes	DPR for Sewerage system in Sewerage District Patna	The proposed SPS,STP will be indoor which will prevent noise and enclosed nature and appropriate cleaning and maintenance will prevent odour nuisance
Construction	Excavation, Cutting and filling operations	Review of existing infrastructure, shoring trenches, reinstatement/ resurfacing	Yes	DPR for Sewerage system in Sewerage District Patna	The proposed DPR includes these activities
	Damage public utilities	Proper reviewing of existing drawing s of utilities, informing concern authorities	Yes	DPR for Sewerage system in Sewerage District Patna	The proposed DPR includes these activities

	and reinstatement of public utilities				
Dust generation	Water sprinkling on excavated material to suppress dust and provision of top cover when transported through vehicles	No	Water tanker: Rs. Approximately Rs 902880 /- Top cover for dumper truck: Rs. 33750/-	<p>According to DPR 228 Km stretch in each zone will be completed in 3years. This means approximately 228 m will be covered per day. 2280 L of water will be consumed for 228 m using sprinkler average 2 times a day</p> <p>Labour cost-Rs. 150/day</p> <p>Rs. 300/tanker+Rs150/labourer = Rs. 450</p> <p>Per meter cost = Rs. 450/228 m = Rs 1.98/-</p> <p>Total cost for 228 Km= Rs. 451440.00</p> <p>Keeping a 2 day margin for construction and reinstatement of the site</p> <p>2x451440= Rs. 902880/-</p> <p>For 228 km stretch:</p> <p>Rs. 902880/-</p>	

					<p>Top cover:</p> <p>Approximately 30 Sqm of top cover may require for each vehicle. Assuming 5 such vehicle involved in transporting excess soil to dumping location (considering construction schedule and max excavated earth disposal). Hence 5 trucks* required top cover 30 Sqm* Cost of Tripol cover at Rs. 75/ Sqm</p>
Noise and vibrations	Usage of sound barriers or sheets.	No.	Rs. 2011988/-		<p>As per the schedule, the construction of 77.77 km in Saidpur Zone-III and construction of 94.73 km in Saidpur Zone IV and approx 56 km (network at Saidpur STP) has to be executed in 36 months.</p> <p>Hence on an average in Zone III nearly 80m/day will be constructed, while in Zone IV (N), nearly 100 m and 56 m for STP network will be constructed per day. Hence on an average 114 will be constructed considering both the zones.</p> <p>Considering 364 GI sheet of 3'x 8' would cover 114 m length (both sides) of construction activity daily. (228 sheets are needed of for one side of 228 m stretch, so for 2 sides 456 sheets and 2 more sheets to enclose one open side of the barricading; 228 m is taken as a safer option</p>

					<p>as it will not be possible to shift the barrier to another site same day)</p> <p>Hence 456 sheets* Cost of GI sheet Rs.1000 per sheet (Rs.70-100 per Kg)* labour cost (four labours at avg. rate of Rs. 150 per day) = Rs. 1005994</p> <p>And for 228 Kms = Rs. 2011988</p>
	Temporary flooding or , water logging	Alternate traffic re-routing, Ensuring storage of excavated soil material on the higher lying areas	Yes	DPR for Sewerage system in Sewerage District Patna	
	Increased traffic inconvenience	Traffic re-routing	Yes	DPR for Sewerage system in Sewerage District Patna	
	Safety hazards to workers and residents	Putting fences or other barricades to demarcate the area	No	Rs. 22500	Assuming a stretch of 228m per day, 300 rods will be used, @ Rs. 75/- per rod.
	Health hazards and nuisance	Sanitation	No	Cost of construction of pit and toilet building &	The labour camps can be divided into 1 camp for each zone, for appropriate management and

Labour camps (if adopted)	due to absence of facility for sanitation or solid waste management		cleaning approximately Rs. 15,48,000/-	<p>maintenance work. Per day each camp will have around 300-400 labourers (approx).</p> <p>The approximate cost of one toilet unit in a camp would be around Rs 7,50,000. For constructing toilet at 2 camps expenditure would be Rs. 15,00,000/-</p> <p>Cleaning of pit cost Rs 4000/-. And after 9 months cleaning is needed so thrice cleaning is needed. So for 2 pits X 2 camps X 3 times cleaning the cost will come as Rs.48000/-.</p>
		Water Supply	No Approximately Rs. 28,25,000/-	<p>As estimated 500 laborers will be required. Around 10 stand posts will be needed at one camp. One stand post construction cost is Rs 6250/-. So for 2 camps total cost will be Rs 125000 for construction.</p> <p>At the rate of 100 LPCD, 50000 L i.e. 50KL of water is needed. At the rate of Rs 5KL, the cost of water provisioning would be Rs 300 per day and hence cost for each camp for 50 kl would be Rs 3000/day. Total cost for 30 months would be Rs 2700,000.</p> <p>Total cost of construction and provisioning would be Rs 28,25,000/-</p>

		Dust bins	No	Approximately Rs. 300000/-	Solid waste generation: Generally about 200 grams of solid waste is generated per 5 persons every day. Hence two cluster dustbin (one for biodegradable waste and one for non-biodegradable waste of 1 cum size at the rate of Rs. 2000/-) may handle solid waste generated.
Construction	Fly Nuisance at STP	Application of insecticides	No	Lumpsum Cost Rs. 300000/-	
	Treatment of Disposal of Sludge	Ensure proper functioning of STP for digestion of sludge	No	Lumpsum Cost Rs. 400000/-	
	Sludge Monitoring	Analysis of sludge and its neutralization	No	Lumpsum cost Rs. 400000/-	
	Tree Plantation & Landscaping		No	Lumpsum cost Rs 400000/-	
	Training and Awareness generation	Among the workers of construction camp and operators of STP and Monitoring and Evaluation expert	No	Lumpsum Rs 200000/-	
Total Cost of Environment Management				Rs 9344118/-	

Total cost for EMP is estimated to be approximately Rs. 9344118/- excluding budget for environmental monitoring plan.

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Table: 8.6 - Cost of Environmental Monitoring Plan

Item	Location	Season	Year	Total no. of samples	Unit Cost	Total Cost
Environment Monitoring during Construction Stage						
Air quality Monitoring	8	3	3	72	7,000.00	504,000.00
Metrological data	1	4	3	12	5,000.00	60,000.00
Noise / vibration	8	3	3	72	2,000.00	144,000.00
Water analysis	8	3	3	72	6,500.00	46,8000.00
Soil analysis	8	2	3	48	5,500.00	264,000.00
Travel and Transportation of monitoring Team	Lumpsum					100,000.00
Sub total						1590,000.00
Environment Monitoring Cost (Operation Stage)						
Air quality Monitoring	8	1	5	40	7,000.00	280,000.00
Metrological data	1	1	5	5	5,000.00	25,000.00
Noise / vibration	8	1	5	40	2,000.00	80,000.00
Water analysis	8	3	5	120	6500.00	780000.00
Soil analysis	4	2	5	40	5,500.00	220,000.00
Travel and Transportation of monitoring Team	Lumpsum					100,000.00
Sub-Total						1,485,000.00
TOTAL for Environmental Monitoring						3,025,000.00

Total Cost of EMP and Environmental Monitoring (Total of Table 8.3 and Table 8.4)	1,2369118.00 Say 1.24 Crore
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8.4.1 Environmental / Social Management Plan

8.4.2 Social mitigation plans during construction phase

Based on the identified social issues, doable mitigation plans are proposed. Some of these measures are already listed in the DPRs, and some of them are additionally recommended for social development of the project and the concerned stakeholders.

i. Impact on human health

Mitigation Measure: Acoustic enclosures or hoardings can be constructed at the proposed sites

Mitigation plan involves the erection of temporary enclosures around construction sites. These barriers will help entrap some of the dust that is brought up in digging. They will also provide safety benefits, to be detailed below. According to the interaction/consultation with the key stakeholders, it was said that contractors are doing water sprinkling in the construction area.

ii. Traffic Congestion

Mitigation Measure: Re-route traffic whenever possible and employing traffic police to manage the traffic movement.

Traffic must be re-routed to facilitate ease of movement. Proper signage should provide detailed information on the dates and duration of road closures and which detours will be available, ideally well in advance of actual construction so residents can plan accordingly. Strategic placement of traffic police at critical intersections will also facilitate better flow of traffic. Plans and budget for these measures are already included in the DPR.

iii. Impact on livelihood

Sewer constructions will invariably lead to road closures, which will adversely affect shops on those streets. The first priority is for the contractor to take the necessary measures to ensure that pedestrians always have access to shops, vendors, etc. For mobile vendors, this may include adjusting the location of the cart, etc. to a similar location in the immediate vicinity of the original location for the duration of the project. Projects should also proceed on schedule so as to minimize disruption.

Additionally, clean-up of debris and clearance of blockages should commence immediately after project completion so as to remove any potential obstacles that might prevent customers from accessing businesses or other disruptions.

In the event that the contractor, despite best efforts, is unable to avoid blockages of the roads and/or disruption of local businesses, some compensation is necessary. The ESMF currently mandates compensation only in the case of permanent livelihood loss or displacement and provides no provisions for livelihood loss of mobile vendors. Additionally, no regulation, policy, guideline, etc. exists which can provide precedent or guidance in this instance. ESMF clearly states that mobile/ambulatory hawkers: fruit cart vendors, etc. who can easily relocate fall into this category. These vendors are most eligible for a temporary relocation just outside the construction area, and will thus not be eligible for compensation as is the case for this proposed project. However if during the construction of the project any party faces livelihood loss due to the proposed project, then that party should be compensated according to the entitlement matrix given in the ESMF report.

iv. Impact on existing utility services

Mitigation Measure:

- 45 Circulating the layout plans of the existing underground alignment near the work site.
- 46 Contacting the relevant department in case there is any damage to any of the utility services and ensuring prompt fixing/replacing of damaged infrastructure

v. Safety hazards

Mitigation Measure: Fencing of the excavation site and providing proper caution sign boards.

As mentioned above, fencing should be erected around construction sites and appropriately marked with caution signage. These fences/signs should remain in place even if construction is not active, so long as a hazard (e.g. open pit) remains.

Currently, no provision for fences are explicitly mentioned in the DPR, and, in field visits to JNNURM sites, some had fences while others did not.

vi. Elevated Noise Levels

According to officials, construction will take place after school hours or at other times of school closing to avoid interfering with school function. Beyond that, construction must simply proceed in a deliberate and judicious manner to avoid unnecessary noise pollution.

vii. Failure to Restore Temporary Construction Sites

As mentioned above, provisions to rehabilitate roads and clear debris are already included in the DPR.

viii. Public Notice:

According to the suggestion given by locals during the interview. Government and contractor should give a prior notice to each and every locality with the details of project, street wise start date of construction and street wise end date of construction, contact person during emergency. This information would help them better adjust to the situation and make necessary adjustments and provisions.

8.5 Assess the Capacity of Institutions and Mechanisms for Implementing Social Development Aspects and Social Safeguard Plans; Recommend Capacity building measures

Roles and functions of the institutions are pre-defined, but they can enhance their capacity for better implementation and operation of the project. There should be synergies and continual interaction amongst the departments for better coordination. The officers of the relevant departments can be trained in social sciences, social management plan, etc.

Institutional reform and capacity building of local body is in process under JNNURM, it will be required to ensure that operating authorities have the ability and equipment to properly manage and finance the operation and maintenance of sewerage schemes. Otherwise continued development will not be sustainable.

Table 8.7 : Role of stakeholder in implementation and mitigation

Stakeholder Category	Role in project implementation	Role in mitigation
NGRBA	Over all coordination	Coordinating so that the mitigation plan is implemented well Ensuring funds for mitigation plan execution
Executing agencies (Jal Nigam, Ganga Pollution Control Unit)	Implementation of the project by awarding the project to the suitable contractor and regional coordination Informing the relevant departments about the progress of the project	Ensuring that the relevant departments are available for mitigation plan Enough safety provisions are available for the project implementation.
Jal Sansthan	While execution of projects related to sewerage line, Jal Sansthan is responsible for the maintenance of trunk sewers.	Should ensure that the basic amenities are in order during the operational phase of the project construction and
Municipality	Ensuring better access to households	Should ensure all the households envisaged at project planning phase gets access to the services. Weaker section of the society should get equitable share.
State, local Government	Coordination Monitoring and evaluation	Coordination Monitoring and evaluation Ensure all the safeguarding plans are in line and acted upon.

NGOs, CSOs, Research Institutes (Patna University)	Awareness creation about the project activities Community participation damage caused to the public utility functions like drinking water pipe lines for better project implementation	Public participation and coordination
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8.6 Develop Monitoring and Evaluation Mechanisms to Assess Social Development Outcomes

Regular monitoring and evaluation of the project activities should be carried out to judge its success or any gaps. Certain key parameters can be taken as the benchmark for monitoring and evaluation of the project based on the identified development outcomes. Some of the indicators are listed below;

- 47 Increase in sewer access (number of households linked to the sewer network)
- 48 Decrease in effluent discharge into the Ganga (water quality assessment of the river)
- 49 Proper sites for industries, building etc.
- 50 Accessibility of the service to backward and weaker sections of the society
- 51 Increase in public toilet
- 52 Increase in the land rate (property appreciation value)

9.0 Conclusion

The project report of the proposed sub-project for sewerage Saidpur Zone after environment analysis concludes that the project falls in 'low impact' category and have overall positive benefits on the life and environment of the people. There has been no reported land acquisition or livelihood losses to be caused under this project. As per environmental and social management framework guidelines of NGRBA, Environmental and Social Assessment, with a Generic Safeguard Management Plan was conducted for addressing possible issues/ concerns arising from proposed project.

Impacts of activities identified during the assessment fell under two separate categories of Construction and Operation. Although no such permanently negative or adverse environmental or social impacts were identified, there were certain temporary impacts, for which appropriate mitigation plans have also been suggested. The environmental management plan ensures to suggest appropriate mitigation measure against the issues/ concerns identified during the environmental and social analysis study. All the social and environmental issues were appropriately studied and have been substantiated using appropriate evidences, to ascertain the magnitude of their impacts. Even the issues of public grievances and public notice have been taken care in the report to confirm transparency during the project implementation. Report also ensures that well defined institutional mechanism is in place to monitor and evaluate the progress of the project during construction, implementation and operation phases.